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Berkeley, California

SOME ASPECTS OF SHIPSIDE REFRIGERATION AT SAN FRANCISCO

BY

THE STAFF OF THE COLLEGE OF AGRICULTURE

December, 1930

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December 4, 1930.

California State Board of Agriculture
State Capitol
Sacramento, California

Gentlemen:

I have the honor to transmit herewith a report on "Some Aspects of Shipside Refrigeration at San Francisco" which has been prepared by the College of Agriculture of the University of California in response to the request you made of us several months ago.

In the preparation of this report previous studies on refrigeration by the University and other agencies have been drawn upon. Some new data have been assembled from various sources.

Numerous agencies assisted by furnishing material to the members of the University's staff who made the study. Several gave liberally of their time. Mr. Charles C. Bowen, Chief of the California Bureau of Commerce and his staff, and Mr. W. F. Carroll, Deputy Agricultural Commissioner of San Francisco, rendered valuable assistance.

The object of the investigation was to estimate the possibility of materially increasing California exports of perishable commodities, particularly fresh deciduous fruits, by the adoption of the practice of shipside refrigeration. The problem of shipside refrigeration might be approached from other points of view, such as the development of the San Francisco Bay Harbor. However, such studies fall primarily in the fields of agencies other than the College of Agriculture.

This report is the joint product of a committee of the staff of the College of Agriculture consisting of Messrs. F. W. Allen, W. H. Chandler, E. A. Stokdyk (Chairman), H. B. Walker, and C. H. West. The conclusions represent the best judgment of this group.

I have the honor to remain,

Faithfully yours,
C. B. Hutchison, Dean
College of Agriculture
University of California

CONTENTS

SUMMARY

The point of view taken in this study was primarily that of determining whether the adoption of the practice of shipside refrigeration would materially increase the carrying quality of perishable products, particularly fresh deciduous fruits, and thus increase the volume of exports of these commodities.

The port of San Francisco has shown a rate of increase in fresh deciduous fruit exports equal to that of other Pacific Coast ports. However, the volume of exports from San Francisco is not an indication of the total volume of exports of these fruits from California because considerable quantities move via Atlantic Coast ports owing to the fact that the element of time is often an important consideration.

The principal California fresh fruits entering the export trade are apples, pears, and citrus fruits, although exports of grapes have increased in recent years, particularly to European markets. A considerable expansion in pear exports is anticipated. The bulk of citrus exports are from Los Angeles.

The Pacific Coast ports attract the export shipments from their natural trade territory. The breaking points in the freight rate structure tend to define the trade areas for the various ports. However, shipments are sometimes made via ports other than the port of the natural trade area because ships bound for certain foreign ports do not call at all Pacific Coast ports.

The amount of refrigeration space available in ships calling at Pacific Coast ports has been expanded recently. In the fall and winter months most of this space is filled to capacity, but during a large part of the year it is not.

Cold-storage space in northern California totals about 14,000,000 cubic feet. In San Francisco sufficient space is available to handle peak loads. At interior points the plants are often taxed to capacity at certain seasons of the year. The State Products Terminal has seven cold-storage rooms with a capacity of 210,000 cubic feet, or space for 90,000 boxes of apples. Maximum berthing space available, including emergency space at piers 44 and 46, is 3,200 feet. There are five berths, located at 240 ft., 310 ft., 610 ft., 740 ft., and 790 ft., respectively, from the center of the warehouse, measuring from the center of each berth (page 27).

Nominally, cold-storage rates are lower in many eastern cities than in California cities. This tends to handicap expansion of cold-storage business in California unless the difference in rates is compensated by increased efficiencies, as is the case of some of the better plants of the state. With some commodities storage-in-transit privileges are granted at several eastern points but are not available at San Francisco; with other commodities these privileges are obtainable at San Francisco for an extra charge of $15.00 per car. This tends to check extensive seaboard storage-in-transit development at San Francisco for goods which may later be routed overland to transcontinental markets.

The larger percentage of early California fruits are transported from points of production to San Francisco by truck or in nonniced cars. These shipments reach their destination within 2 to 12 hours and are usually in transit during the night.

Temperatures on the San Francisco docks during the summer and fall months fluctuate within a narrow range, around 65° Fahrenheit. As this is a temperature materially lower than that under which most of the fruit is grown, it furnishes very favorable conditions for assembling and loading.

Aside from fall and winter pears, largely grown in the Santa Clara Valley, where excellent cooling and storage facilities are at hand, only a small percentage of fruit arriving in San Francisco is precooled at the point of origin.

Fruit arriving in San Francisco for immediate export shipment is usually unloaded at the piers and is marked and sorted into various lots for different ports before being placed in the ship's hold. Some shipments are delivered to the stores of exporters and subsequently to shipside. Large lots of apples, pears, or grapes arriving in iced cars are sometimes loaded direct.

Two or 3 hours is the usual period for shipments of the more perishable products to remain on the docks prior to loading. There is, however, an occasional delay of 24 hours. With fruits of better keeping quality from 25 to 50 per cent of the shipments are subject to such delay. The increase in temperature of the fruit thus delayed varies from 0° F. with noncooled fruit to 15° to 20° F. with fruit which has been in cold storage. The latter sweats badly with the increase in temperature.

Temperatures in holds of vessels at the time of loading fluctuate widely, averaging 58° F. In most instances the holds are not precooled and have a temperature approximating that of the outside air. Cold fruit loaded into such temperatures is subject to the same conditions as though it were unloaded on the docks.

It appears that there is no necessity to advocate the more extensive precooling of fruit for export from San Francisco until such time as the volume of export orders justifies ship lines in furnishing the deciduous fruit grower and shipper with temperatures at the time of loading comparable to those available in cold storage.

The present traffic situation in the San Francisco Bay Harbor favors San Francisco rather than Oakland as a location for a shipside cold storage, because most ships handling refrigerated cargo call at San Francisco but do not call at Oakland.

It is not certain that shipside refrigeration facilities should be concentrated at one point because the usual size of fresh fruit cargo is around 8,000 boxes or 160 tons. This amount of tonnage does not warrant the movement of a vessel from its regular slip or quay.

Costs of precooling are closely related to the variability of the plant load. Costs of precooling at shipside at San Francisco are more or less indeterminate owing to the fact that the State Products terminal has

operated for only a short period and under partial capacity. Costs at other Pacific Coast ports were not obtained, fruit precooling being incidental to a general terminal business.

The financing of shipside cold storage varies at different ports. In the New York harbor, the Pennsylvania Railroad is constructing a shipside cold-storage plant. In the San Francisco harbor, where private enterprise doubted the profitableness of shipside refrigeration, the Harbor Board erected shipside cold-storage facilities with general harbor revenue funds.

Shipside refrigeration for fresh fruits is a recent development and may be considered experimental. What the demand for shipside cold storage will ultimately be is difficult to anticipate. The development of the quick-freezing process for the preservation of foods may increase markedly the demand for this service. The San Francisco harbor now has a well-equipped plant ample for the present demand (summer of 1930). The present refrigerator space of 210,000 cubic feet can easily be expanded to 630,000 cubic feet and, with additional sections to the present building, to 2,500,000 cubic feet.

FRESH FRUIT EXPORTS FROM PACIFIC COAST PORTS

Since California products must compete in foreign markets by obtaining a premium for quality rather than on a low price basis, the factor of refrigeration from the point of production to foreign markets is often important. The point of view taken, therefore, was primarily that of determining whether the adoption of the practice of shipside refrigeration would increase materially the carrying quality of perishable products, particularly fresh deciduous fruits, and thus increase the volume of exports of these commodities.

Exports of fresh fruits from Pacific Coast ports have increased rapidly in the past eight years. In 1922, a total of 7,125 tons of fresh fruit was exported from San Francisco, while in 1928 a total of 21,775 tons moved from this port and in 1929 there was a total of 19,774 tons (table 1). The port of Los Angeles showed an increase from 2,149 tons in 1922 to 14,064 tons in 1928 and 64,733 tons in 1929. The figures for Seattle are: 17,164 tons in 1922 and 110,347 tons in 1929; for Portland: 3,889 tons in 1922 and 33,058 tons in 1929 (table 2).[1]

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1. The data for Seattle are not strictly comparable with those of other ports because rail shipments going to Canada are reported as exports from the Seattle customs district. These shipments are principally fresh grapes, berries, peaches, and citrus fruit.

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Fresh fruit exports from San Francisco consist chiefly of apples, oranges, grapes, and lemons. Los Angeles exports are principally citrus fruits. Seattle exports consist mostly of apples, citrus fruits, pears, berries, and peaches. Portland exports are chiefly apples and pears. (See tables 1 and 2).

Oranges comprise nearly 90 per cent of the volume of the citrus fruit exports. Apples comprise between 75 and 80 per cent of the volume of the deciduous fruit exports from San Francisco, 80 to 85 per cent of those from Seattle, and between 90 and 95 per cent of those from Portland.

Trends in Exports.- The trends in volume of exports are shown in figures 1, 2, and 3. Los Angeles has shown the most marked increase in the export of citrus fruits. Seattle shows a more rapid rate of increase in citrus exports than San Francisco, but these exports are principally shipments by rail to Canada.

The trend in exports of deciduous fruits at the various Pacific Coast ports is of most interest, however, because shipside refrigeration has been discussed as a means of increasing exports of fresh deciduous fruits. Figures 2 and 3 show that the rate of increase from Portland, Seattle, and San Francisco has been approximately the same, both for apples and deciduous fruits as a whole. It will be noted by comparing figures 2 and 3 that apple

TABLE 1

EXPORTS OF FRESH FRUITS FROM THE SAN FRANCISCO AND LOS ANGELES CUSTOMS DISTRICTS (1922 - 1929)*

Year		Item	San Francisco Customs District (tons)	Los Angeles Customs District (tons)	State
1922		Lemons	1,761	144	1,905
		Oranges	1,958	1,522	3,480
		Grapefruit	147	118	265
	(1)	Total citrus	3,866	1,784	5,650
		Apples	2,981	224	3,205
		Pears	44	106	150
		Grapes	191	-	191
		All others	43	35	78
	(2)	Total deciduous	3,259	365	3,624
		Total (1) and (2)	7,125	2,149	9,274
1923		Lemons	1,988	53	2,041
		Oranges	3,102	2,589	5,693
		Grapefruit	228	70	298
	(1)	Total citrus	5,320	2,712	8,032
		Apples	3,956	92	4,048
		Pears	225	34	259
		Grapes	267	34	301
		All others	80	204	284
	(2)	Total deciduous	4,528	364	4,892
		Total (1) and (2)	9,848	3,076	12,924
1924		Lemons	2,020	240	2,260
		Oranges	3,891	5,850	9,741
		Grapefruit	308	137	445
	(1)	Total citrus	6,219	6,227	12,446
		Apples	4,821	111	4,932
		Pears	27	3	30
		Grapes	276	119	395
		All others	7	393	400
	(2)	Total deciduous	5,131	626	5,757
		Total (1) and (2)	11,350	6,853	18,203

Data compiled from monthly Blotters of U. S. Bureau of Foreign and Domestic Commerce. Data from this source were converted on the following basis: Lemons, 75 pounds per box; oranges, 70 pounds per box; grapefruit, 60 pounds per box; apples, 42 pounds per box; and apples, 144 pounds per barrel. (Conversion factors courtesy Dr. S. W. Shear.)

TABLE 1 (con.)

Year	Item	San Francisco Customs District (tons)	Los Angeles Customs District (tons)	State
1925	Lemons	1,786	275	2,061
	Oranges	3,191	2,885	6,076
	Grapefruit	259	143	402
	(1) Total citrus	5,236	3,303	8,539
	Apples	3,175	74	3,249
	Pears	58	13	71
	Grapes	648	47	693
	All others	69	204	273
	(2) Total deciduous	3,948	338	4,286
	Total (1) and (2)	9,184	3,641	12,825
1926	Lemons	2,187	347	2,534
	Oranges	3,975	9,333	13,308
	Grapefruit	312	1,232	1,544
	(1) Total citrus	6,474	10,912	17,386
	Apples	5,281	124	5,405
	Pears	154	4	158
	Grapes	827	39	866
	All others	64	242	306
	(2) Total deciduous	6,326	409	6,735
	Total (1) and (2)	12,800	11,321	24,121
1927	Lemons	2,708	343	3,051
	Oranges	4,262	25,173	29,435
	Grapefruit	552	2,535	3,087
	(1) Total citrus	7,522	28,051	35,573
	Apples	7,262	65	7,327
	Pears	297	2	299
	Grapes	1,335	16	1,351
	All others	93	154	247
	(2) Total deciduous	8,987	237	9,224
	Total (1) and (2)	16,509	28,288	44,797
1928	Lemons	2,624	546	3,170
	Oranges	3,326	8,533	11,859
	Grapefruit	568	4,652	5,220
	(1) Total citrus	6,518	13,731	20,249

TABLE 1 (con.)

Year	Item	San Francisco Customs District (tons)	Los Angeles Customs District (tons)	State
	Apples	12,269	92	12,361
	Pears	814	7	821
	Grapes	1,997	53	2,050
	All others	177	181	358
(2)	Total deciduous	15,257	333	15,590
	Total (1) and (2)	21,775	14,064	35,839
1929	Lemons	2,101	3,004	5,105
	Oranges	4,742	56,114	60,856
	Grapefruit	379	4,962	5,341
(1)	Total citrus	7,222	64,080	71,302
	Apples	9,351	161	9,512
	Pears	679	8	687
	Grapes	2,237	290	2,527
	All others	285	194	479
(2)	Total deciduous	12,552	653	13,205
	Total (1) and (2)	19,774	64,733	84,507

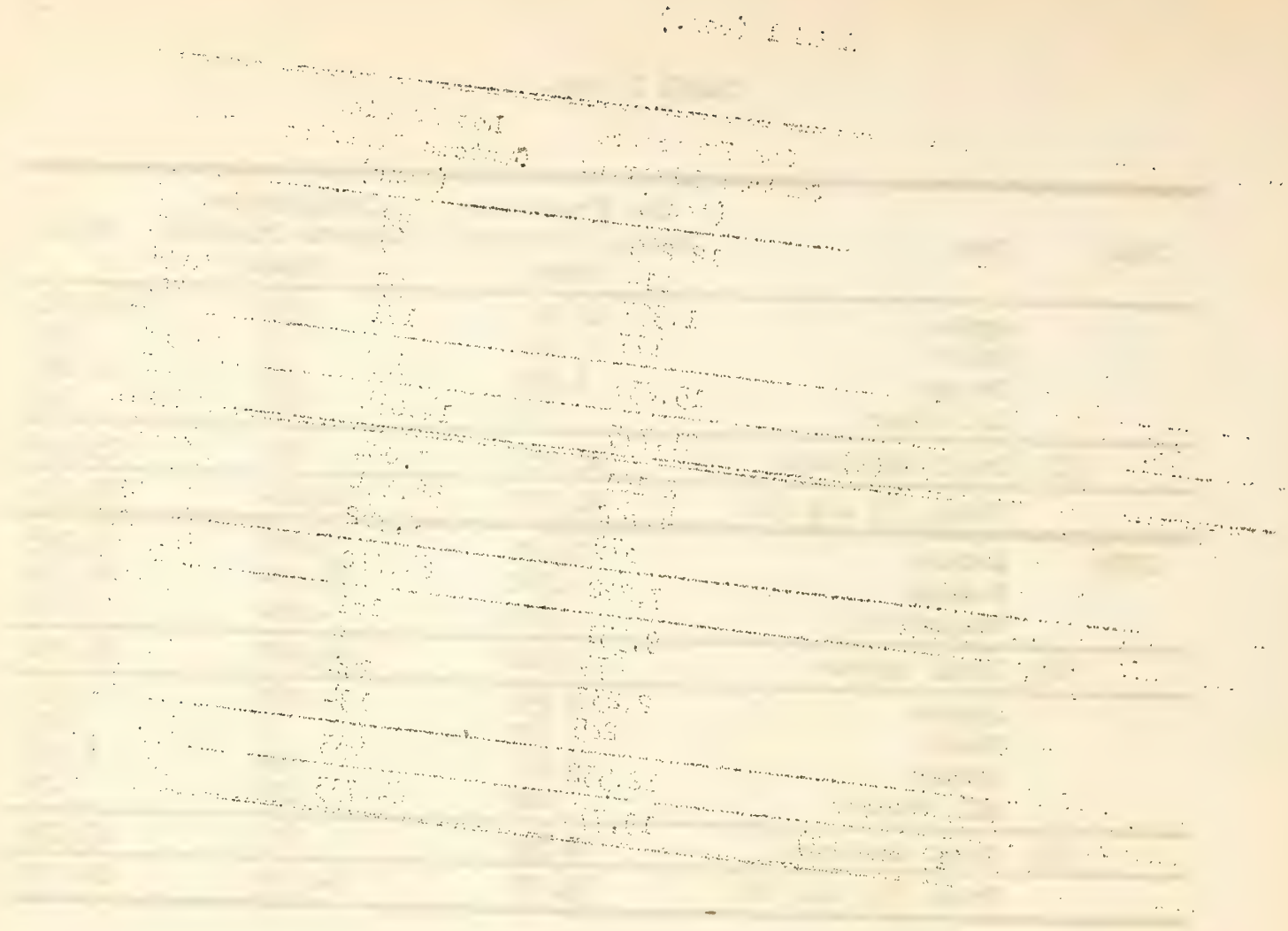


TABLE 2

EXPORTS OF FRESH FRUIT FROM THE SEATTLE AND PORTLAND CUSTOMS DISTRICTS (1922-1929)*

Year	Item	Seattle Customs District (tons)	Portland Customs District (tons)
1922	Lemons	378	
	Oranges	2,717	
	Grapefruit	335	
(1)	Total citrus	3,430	
	Apples	8,685	3,735
	Pears	910	71
	Grapes	578	
	All others	3,561	83
(2)	Total deciduous	13,734	3,889
	Total (1) and (2)	17,164	3,889
1923	Lemons	419	
	Oranges	4,897	
	Grapefruit	571	
(1)	Total citrus	5,887	
	Apples	11,794	14,135
	Pears	1,110	114
	Grapes	649	
	All others	2,847	14
(2)	Total deciduous	16,400	14,263
	Total (1) and (2)	22,287	14,263
1924	Lemons	596	
	Oranges	5,381	
	Grapefruit	434	
(1)	Total citrus	6,411	
	Apples	16,988	20,929
	Pears	629	5
	Grapes	852	
	All others	3,001	
(2)	Total deciduous	21,470	20,934
	Total (1) and (2)	27,881	20,934

Data compiled from monthly Blotters of U. S. Bureau of Foreign and Domestic Commerce. See also footnote table 1.

Year	Item	Seattle Customs District (tons)	Portland Customs District (tons)
1925	Lemons	688	
	Oranges	4,044	
	Grapefruit	643	
	(1) Total citrus	5,375	
	Apples	18,421	20,417
	Pears	2,301	133
	Grapes	1,146	
	All others	4,703	
	(2) Total deciduous	26,571	20,550
	Total (1) and (2)	31,946	20,550
1926	Lemons	1,514	
	Oranges	9,523	
	Grapefruit	868	
	(1) Total citrus	11,905	
	Apples	28,093	29,768
	Pears	1,664	237
	Grapes	1,665	
	All others	3,558	28
	(2) Total deciduous	34,970	30,033
	Total (1) and (2)	46,875	30,033
1927	Lemons	1,437	
	Oranges	11,099	
	Grapefruit	837	
	(1) Total citrus	13,373	
	Apples	33,632	20,487
	Pears	2,003	224
	Grapes	1,717	
	All others	4,647	7
	(2) Total deciduous	41,999	20,718
	Total (1) and (2)	55,372	20,718
1928	Lemons	1,126	
	Oranges	8,906	
	Grapefruit	895	
	(1) Total citrus	10,927	

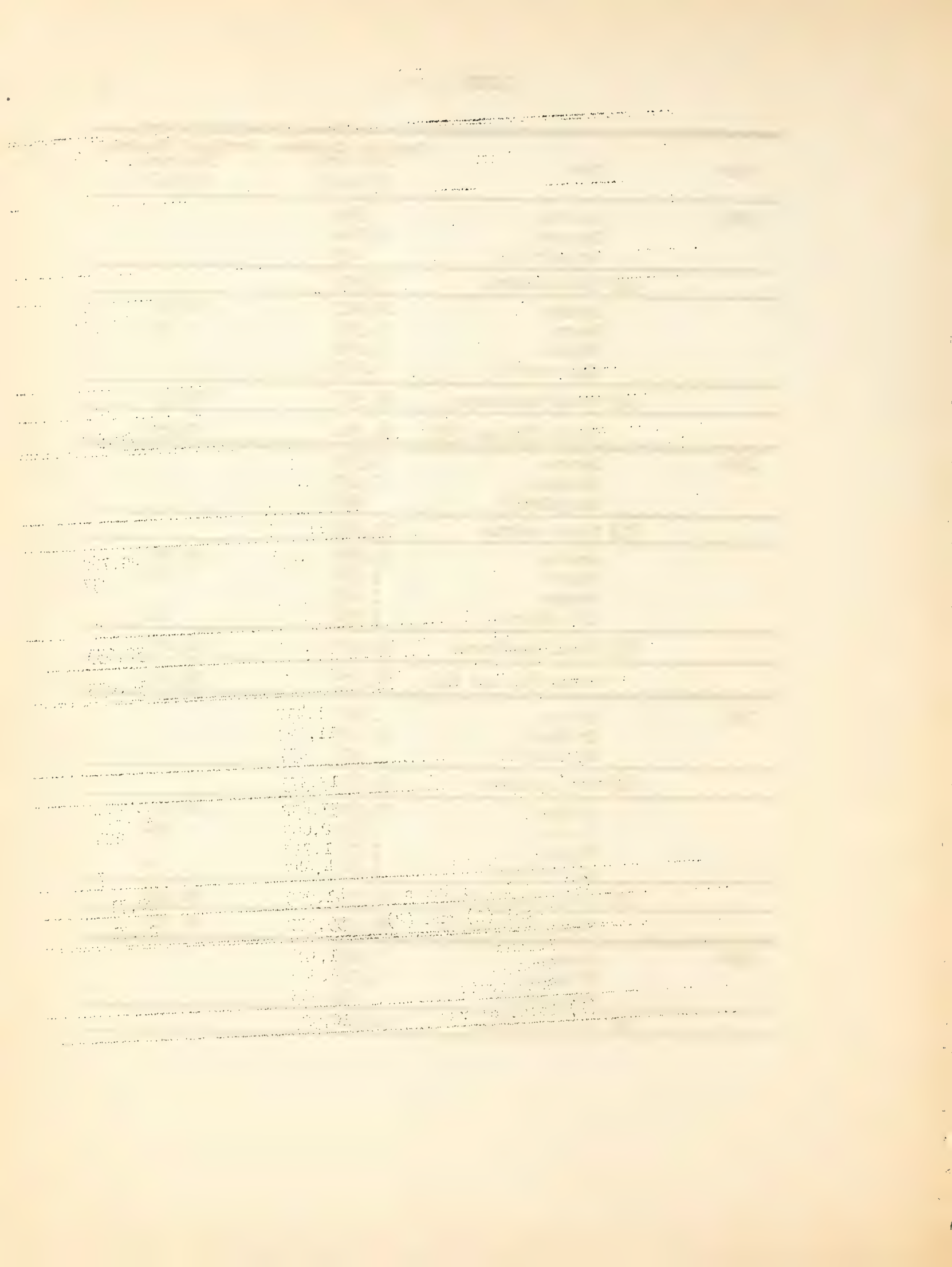
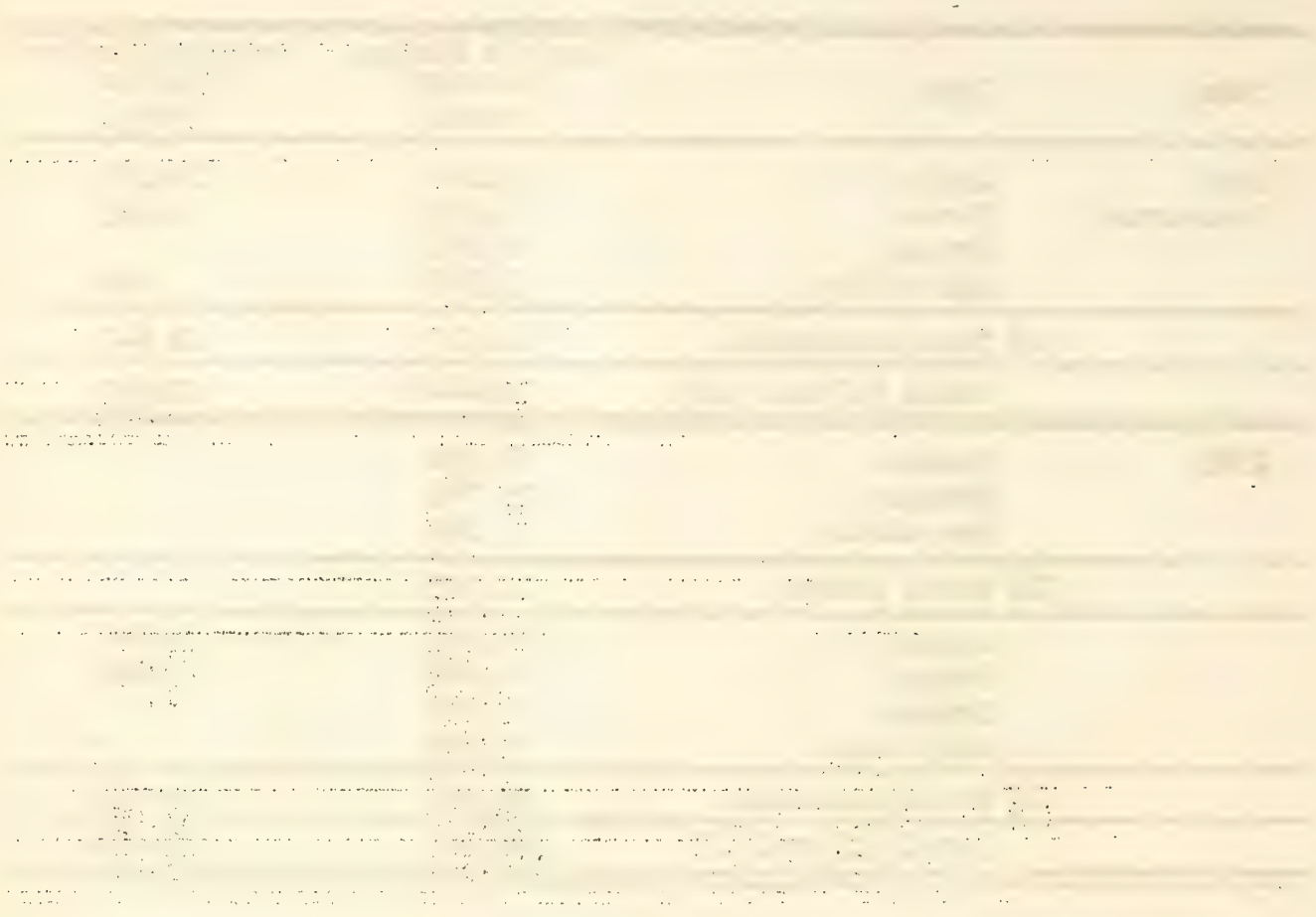


TABLE 2 (con.)

Year		Item	Seattle Customs District (tons)	Portland Customs District (tons)
1928 (continued)		Apples	49,147	19,156
		Pears	4,373	1,483
		Grapes	2,048	
		All others	5,949	404
	(2)	Total deciduous	61,517	21,043
		Total (1) and (2)	72,444	21,043
1929		Lemons	1,358	
		Oranges	15,749	
		Grapefruit	868	
	(1)	Total citrus	17,975	
		Apples	79,113	31,446
		Pears	6,062	1,610
		Grapes	1,728	
		All others	5,469	2
	(2)	Total deciduous	92,372	33,058
		Total (1) and (2)	110,347	33,058



exports dominate all fresh deciduous fruit exports. Pear exports from San Francisco also show about the same rate of increase as other Pacific Coast ports (figure 4).

Exports and Production.- Since apples are the principal fresh deciduous fruit exported, the volume of exports in comparison with the volume of production is of interest (tables 3, 4, and 5). Figure 5 shows total apple production in comparison with the volume of apple exports from the three Pacific Coast states, together with apple exports from three customs districts. Washington has the highest production and the largest volume of exports. California apple production is greater than Oregon apple production, but California apple exports are smaller.

The data presented on trends in exports are difficult to summarize, but it appears that the port of San Francisco has shown a rate of increase in fresh deciduous fruit exports equal to that of other Pacific Coast ports.

EXPORTS OF CALIFORNIA FRUITS FROM ATLANTIC PORTS

It is impossible to obtain definite information on the volume of California deciduous fruit exports that moves through Atlantic Coast ports, owing to the fact that the United States Department of Commerce does not separate exports according to states of origin. Estimates based on statements from several fresh fruit shippers indicate that between 60 and 75 per cent of early apple exports move through Atlantic ports, while only 10 per cent of late apple exports take this route. This percentage varies, however, with market conditions in the several importing countries. For example, according to Mr. E. C. Merritt, Manager of the Sebastopol Apple Growers Union, ordinarily 60 per cent of the exports of Gravensteins to Europe move through Atlantic ports, but in 1930 only about 40 per cent moved through these ports. When European markets are active the time element is important and a greater volume is moved through Atlantic ports than when these markets are inactive. Table 6 shows that considerable savings in freight may be made by shipping via San Francisco if comparable refrigeration service is furnished. Yet, as was pointed out above, the time element is often more important than the saving in freight.

SHIPMENTS VIA WATER TO ATLANTIC COAST

The feasibility of shipping fresh fruit by water to eastern United States markets has been given considerable attention by various agencies, including the Foreign Trade Department of the State Chamber of Commerce under the direction of Mr. Leonard Gary, and the Vallejo Chamber of Commerce. When time is not important such shipments are feasible. However, they are largely restricted to shipments which will be either consumed in the eastern ports or exported, because a back haul of more than 100 miles from Atlantic ports involves storage, cartage, and transportation charges which are equivalent to the savings in freight charges that may be made by shipping via the Panama Canal.

SHIPMENTS OF MEATS AND POULTRY PRODUCTS

Fresh meat exports from San Francisco have been limited because California is on an import basis for most meats, with the exception of lamb

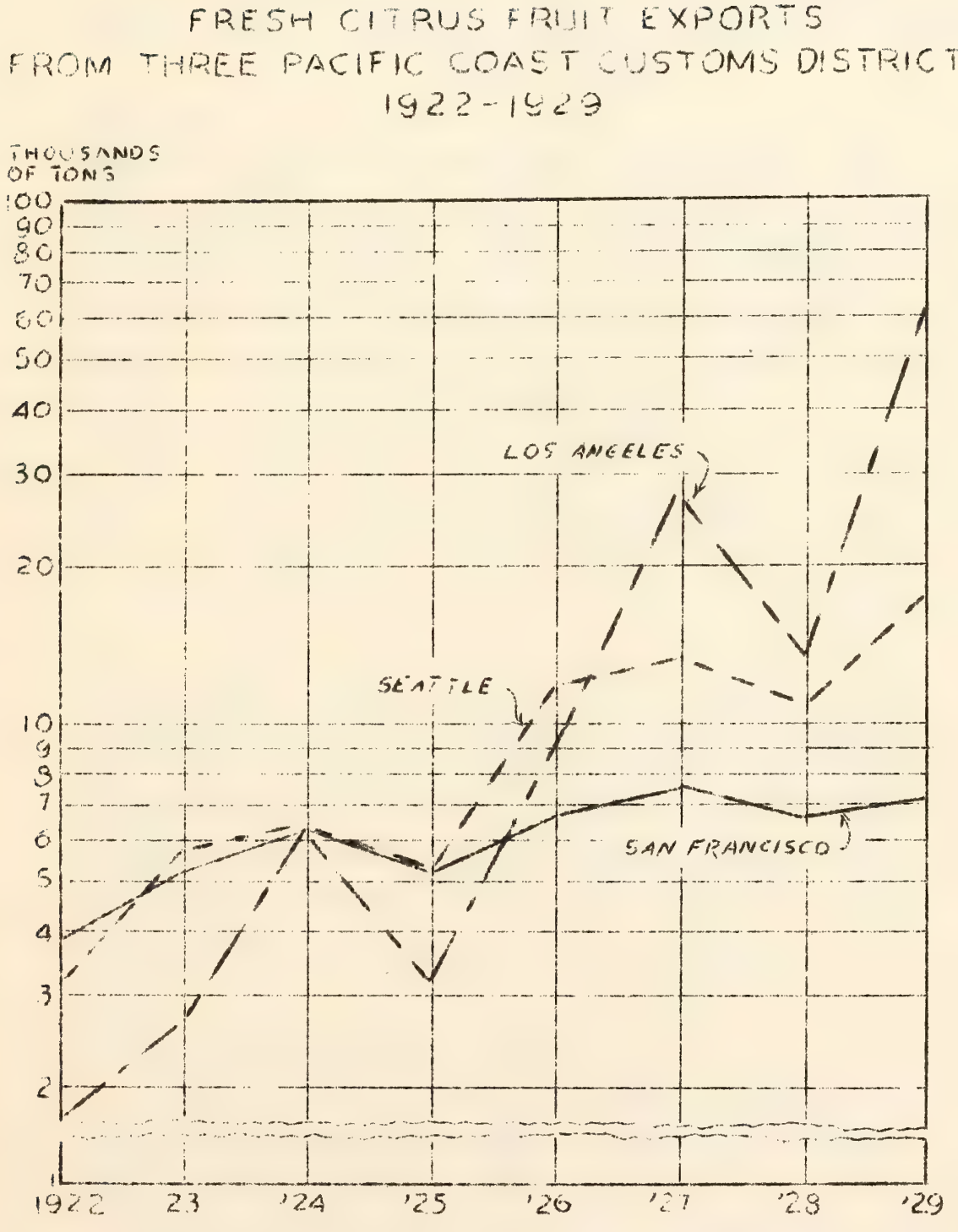
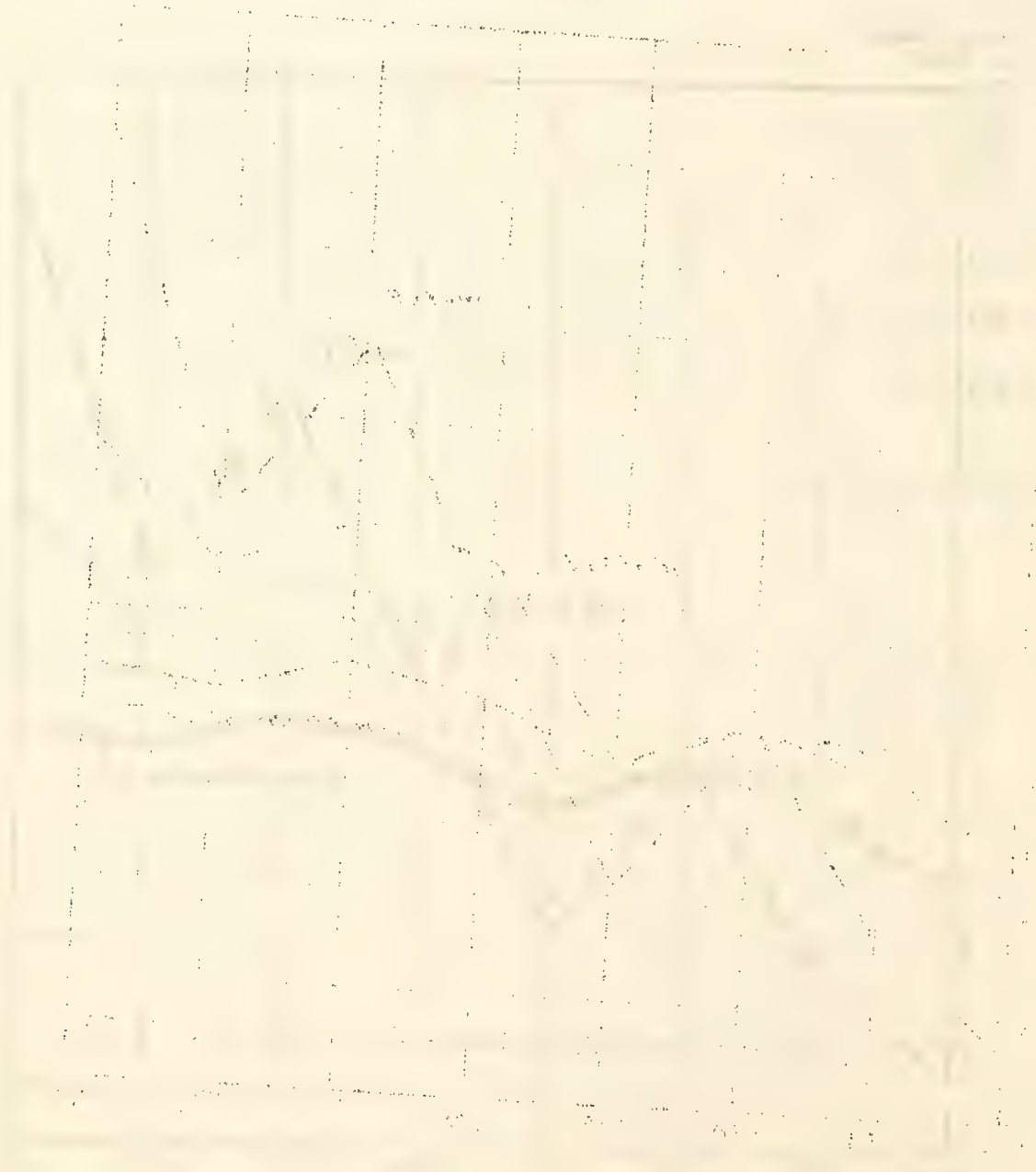


Fig. 1. Exports of citrus fruits from the Los Angeles and Seattle customs districts have increased markedly in the past four years. The exports credited to the Seattle customs district are, however, principally rail shipments to Canada.



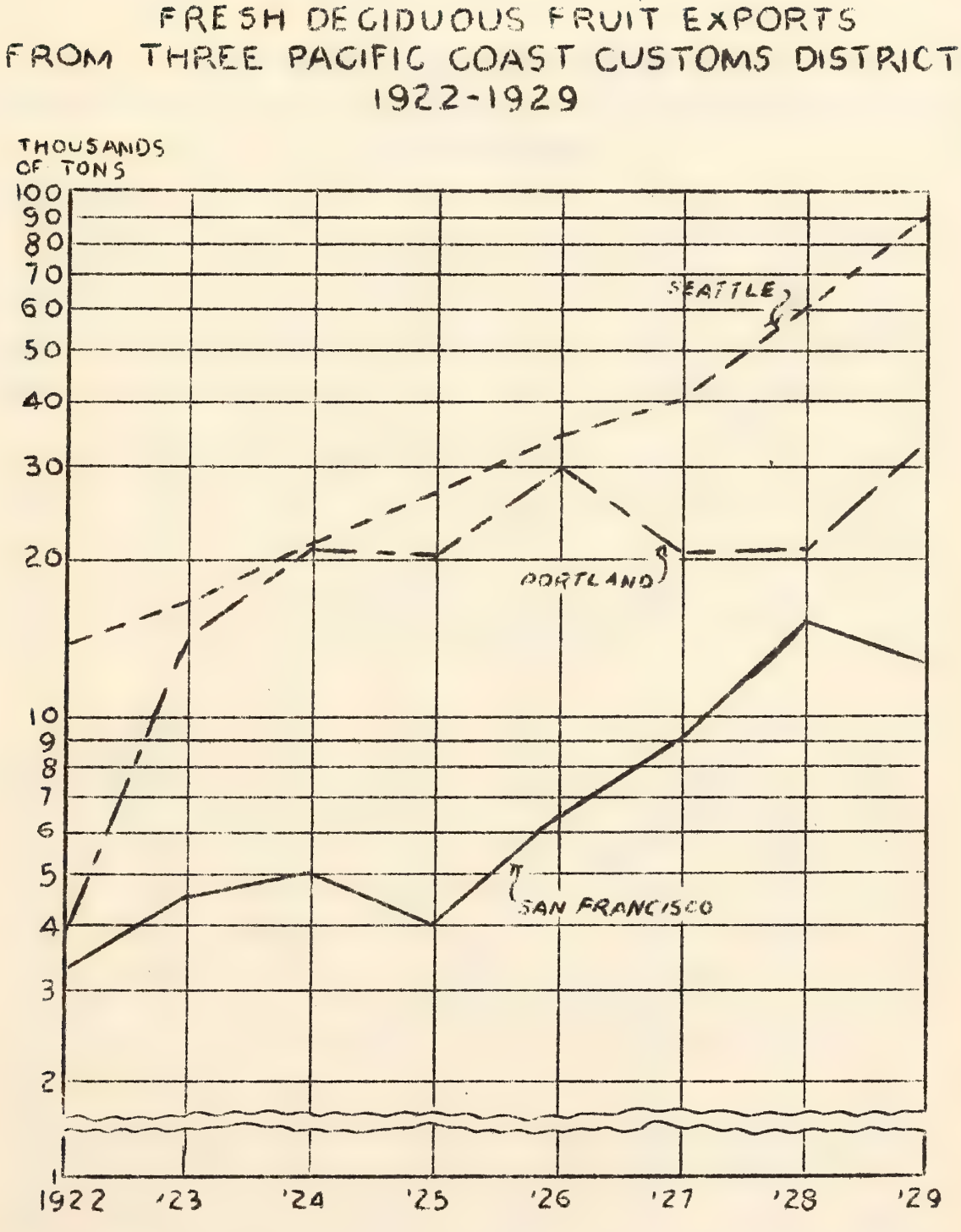
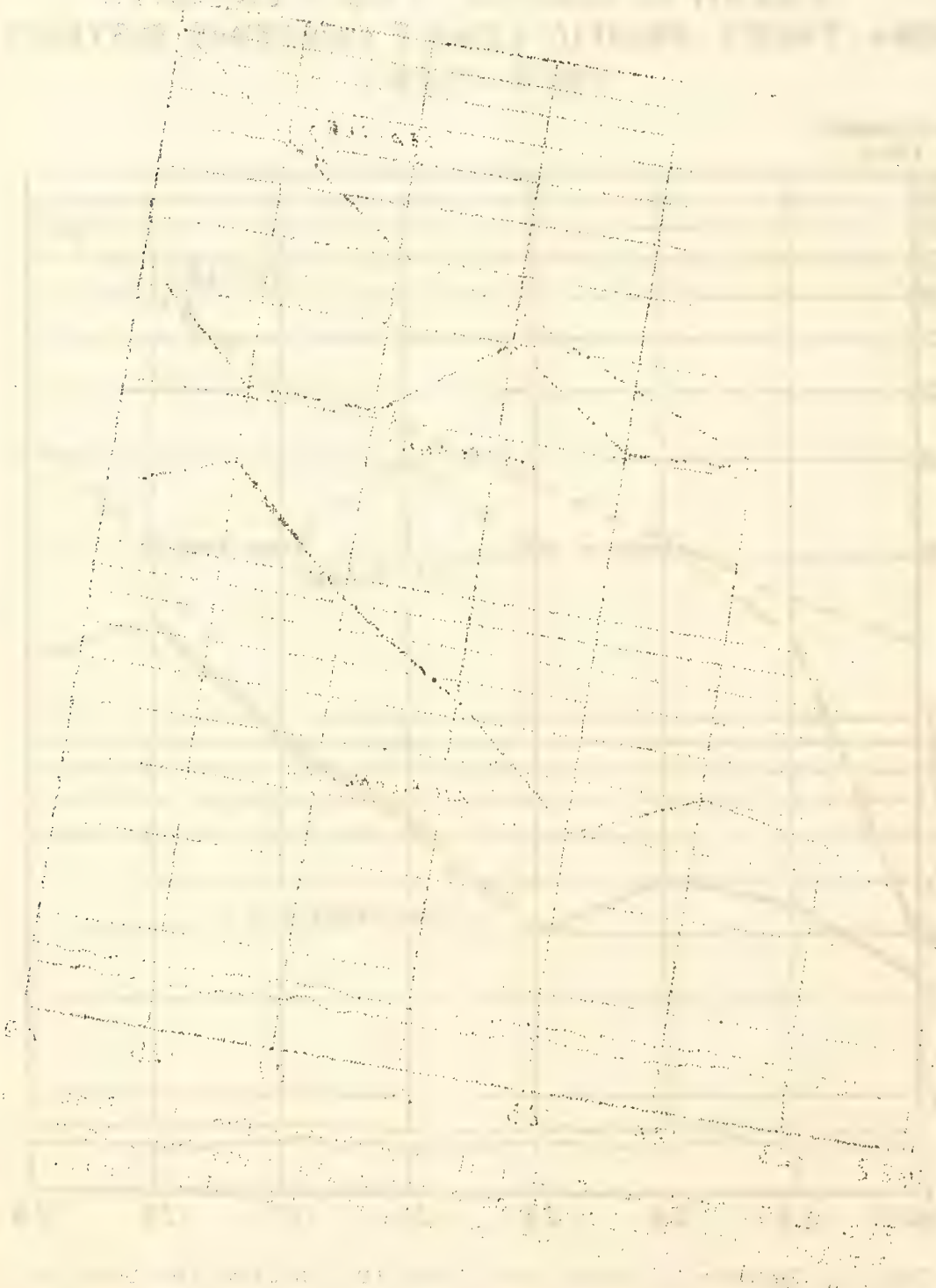


Fig. 2. Exports of fresh deciduous fruits from the Seattle, Portland, and San Francisco customs districts have increased at approximately the same rate in the past eight years.



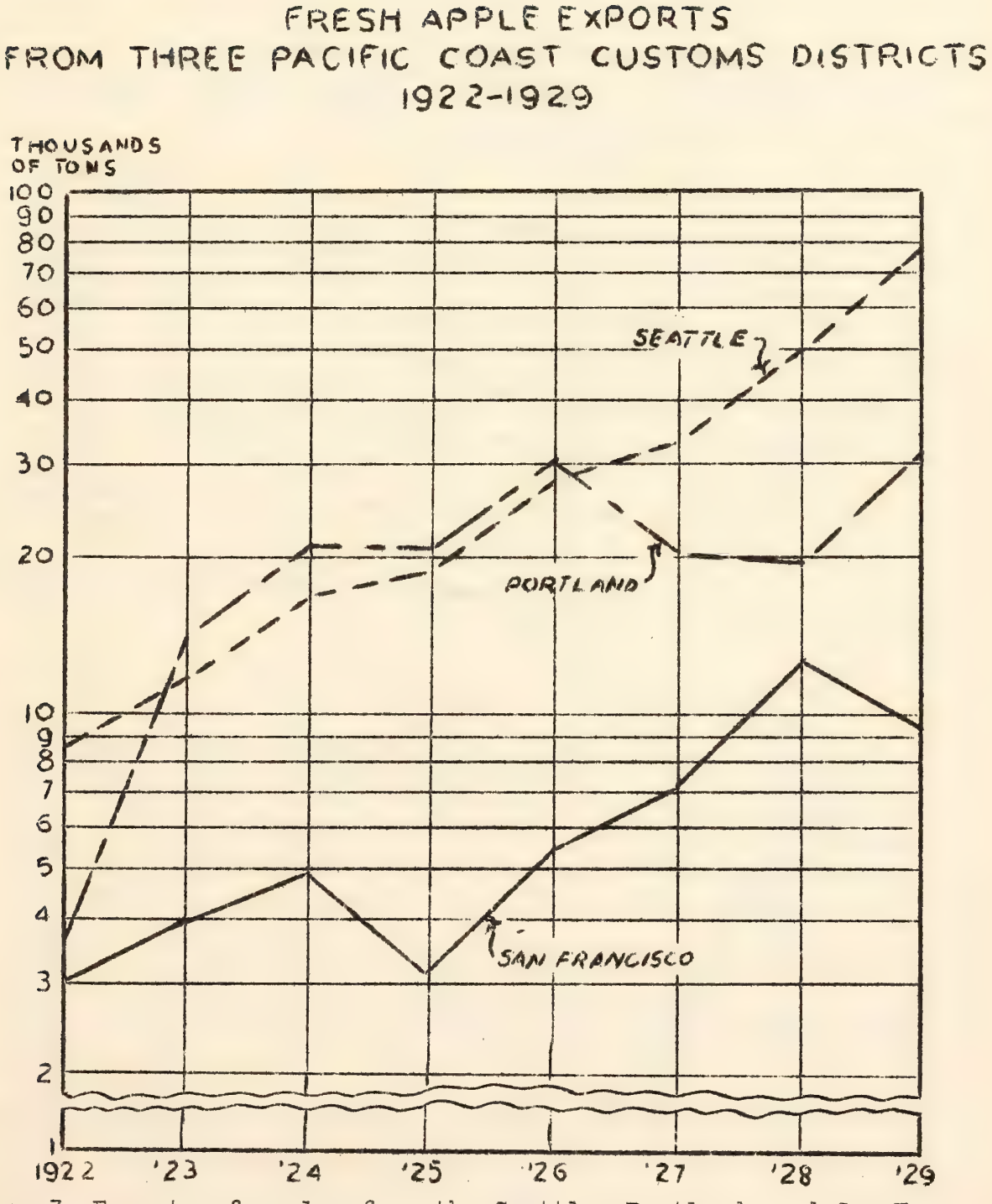
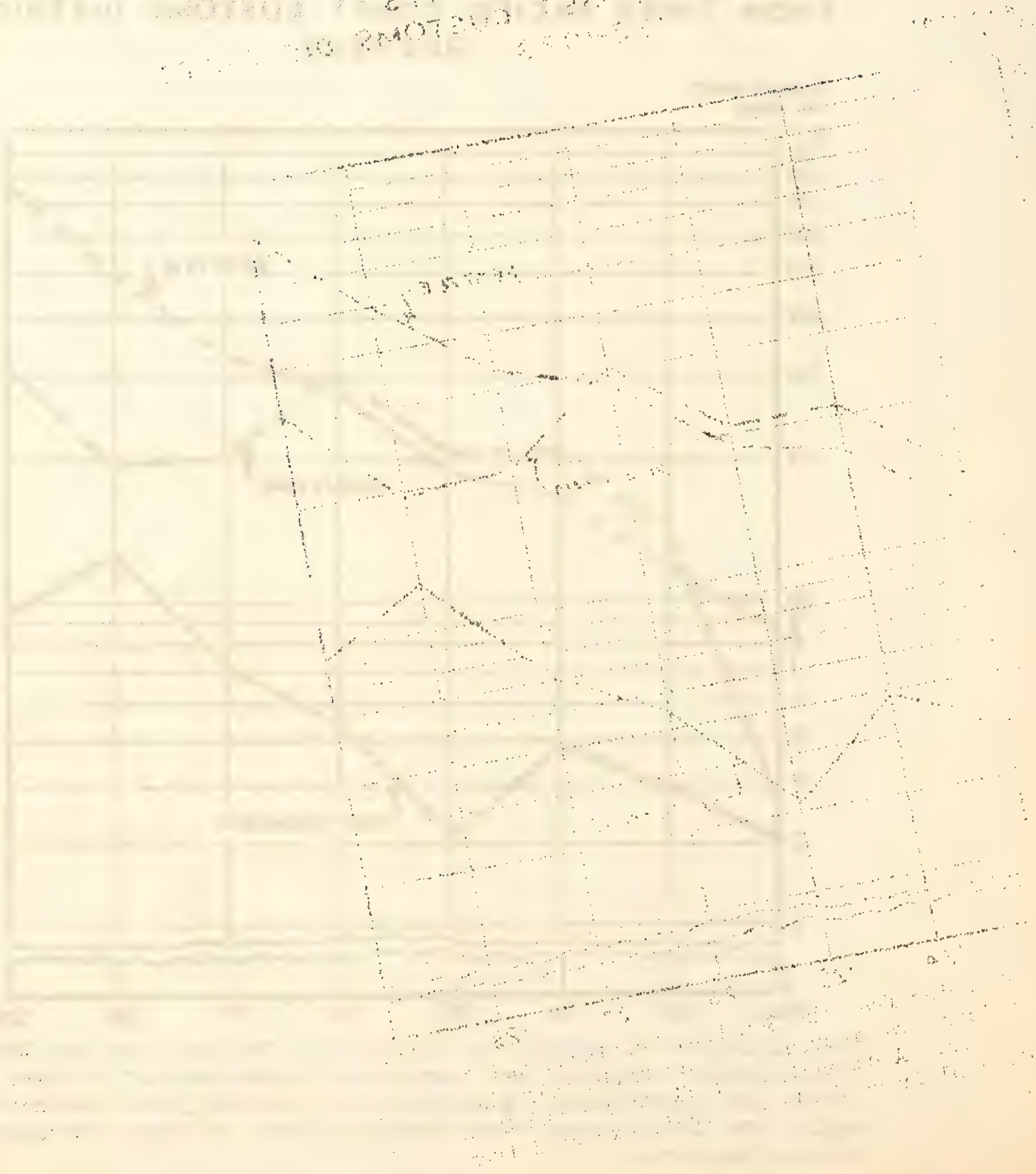


Fig. 3. Exports of apples from the Seattle, Portland, and San Francisco customs districts have increased at approximately the same rate in the past eight years. A comparison of figures 3 and 2 shows that apples are the principal fresh deciduous fruit exported from these customs districts.



FRESH PEAR EXPORTS
FROM THREE PACIFIC COAST CUSTOMS DISTRICTS
1922-1929

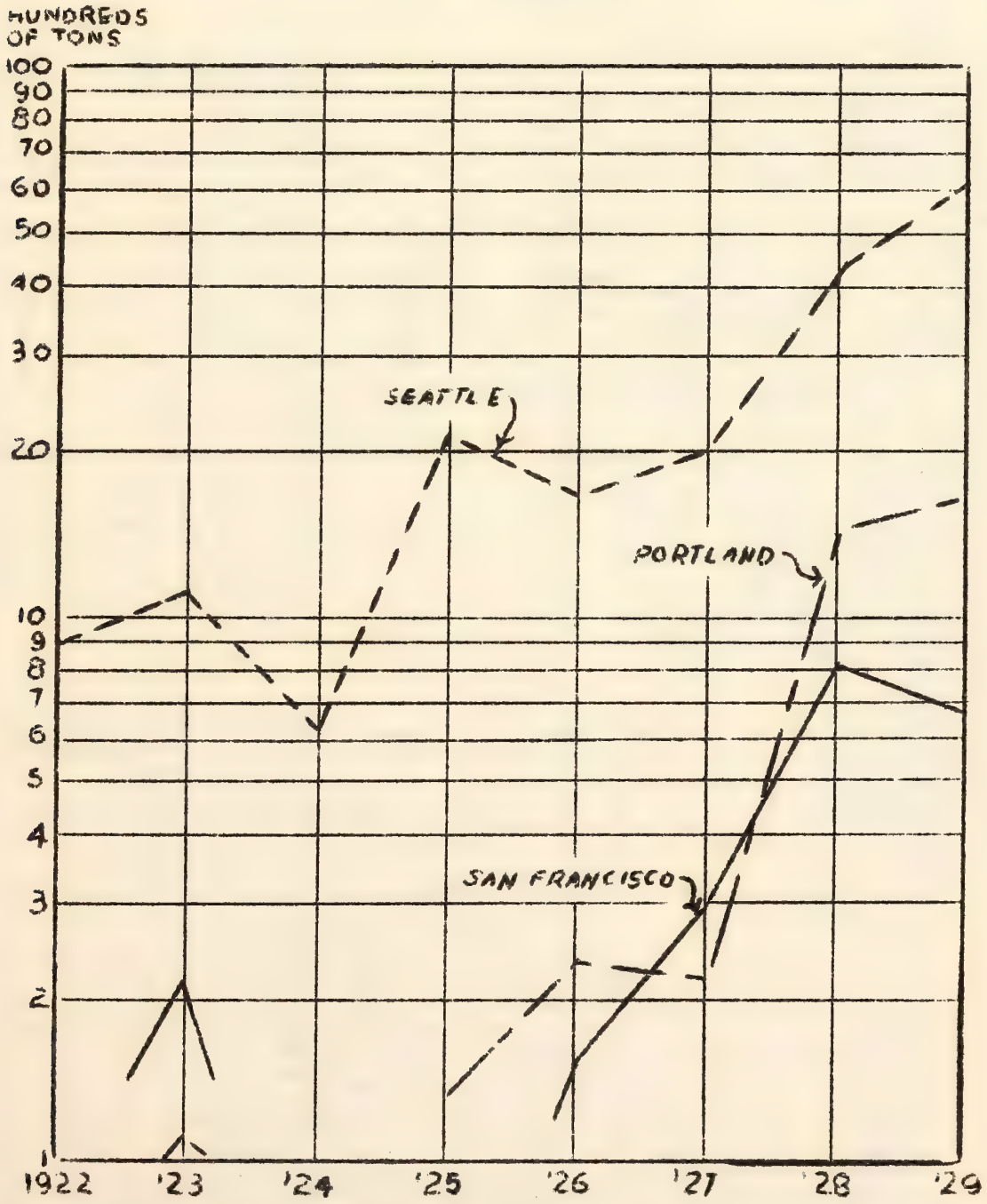
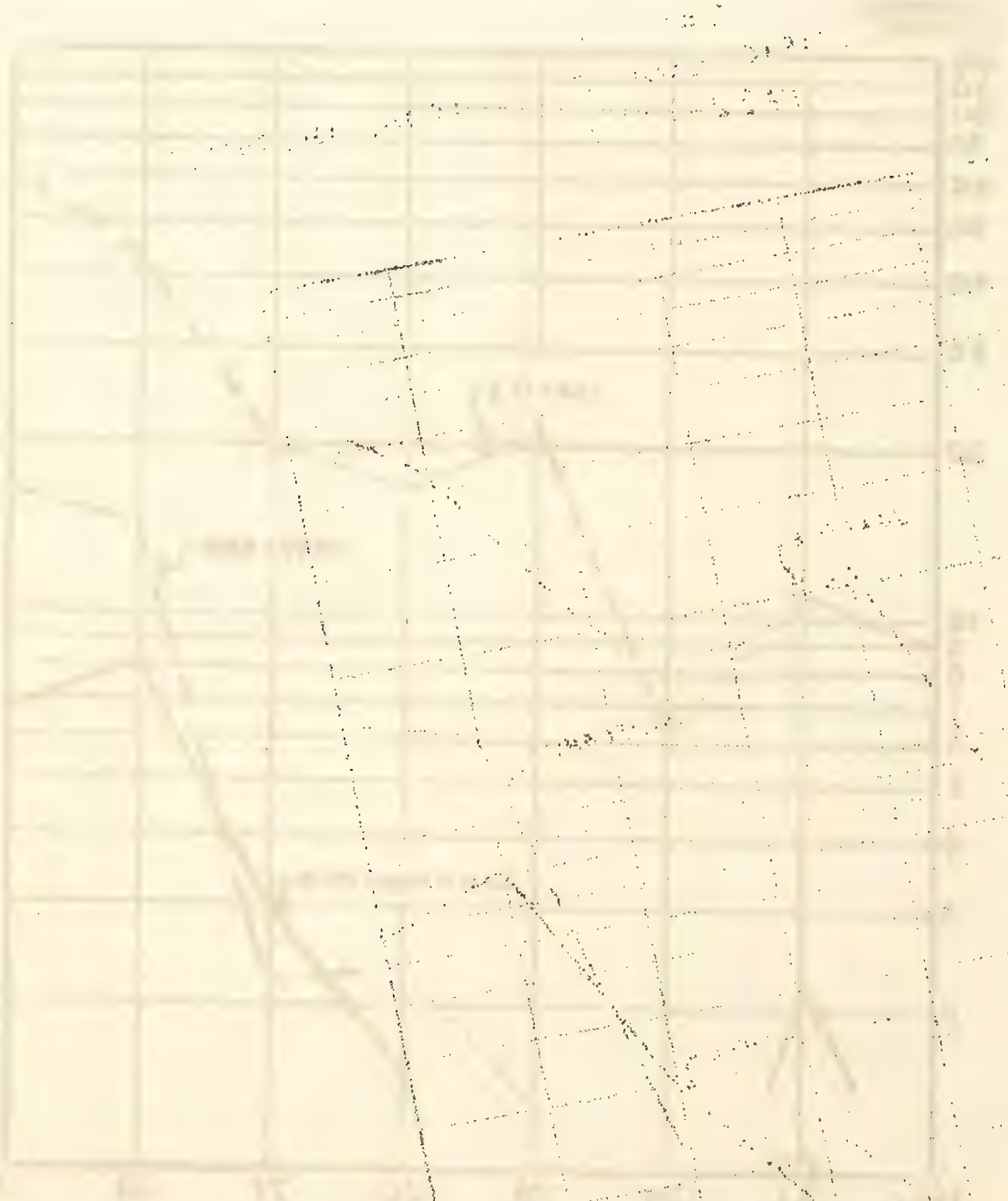


Fig. 4. Fresh pear exports from the Seattle, Portland, and San Francisco customs districts have increased at approximately the same rate in the past four years.



APPLE PRODUCTION IN PACIFIC COAST STATES AND FRESH APPLE EXPORTS

FROM THREE CUSTOMS DISTRICTS, 1922-1929

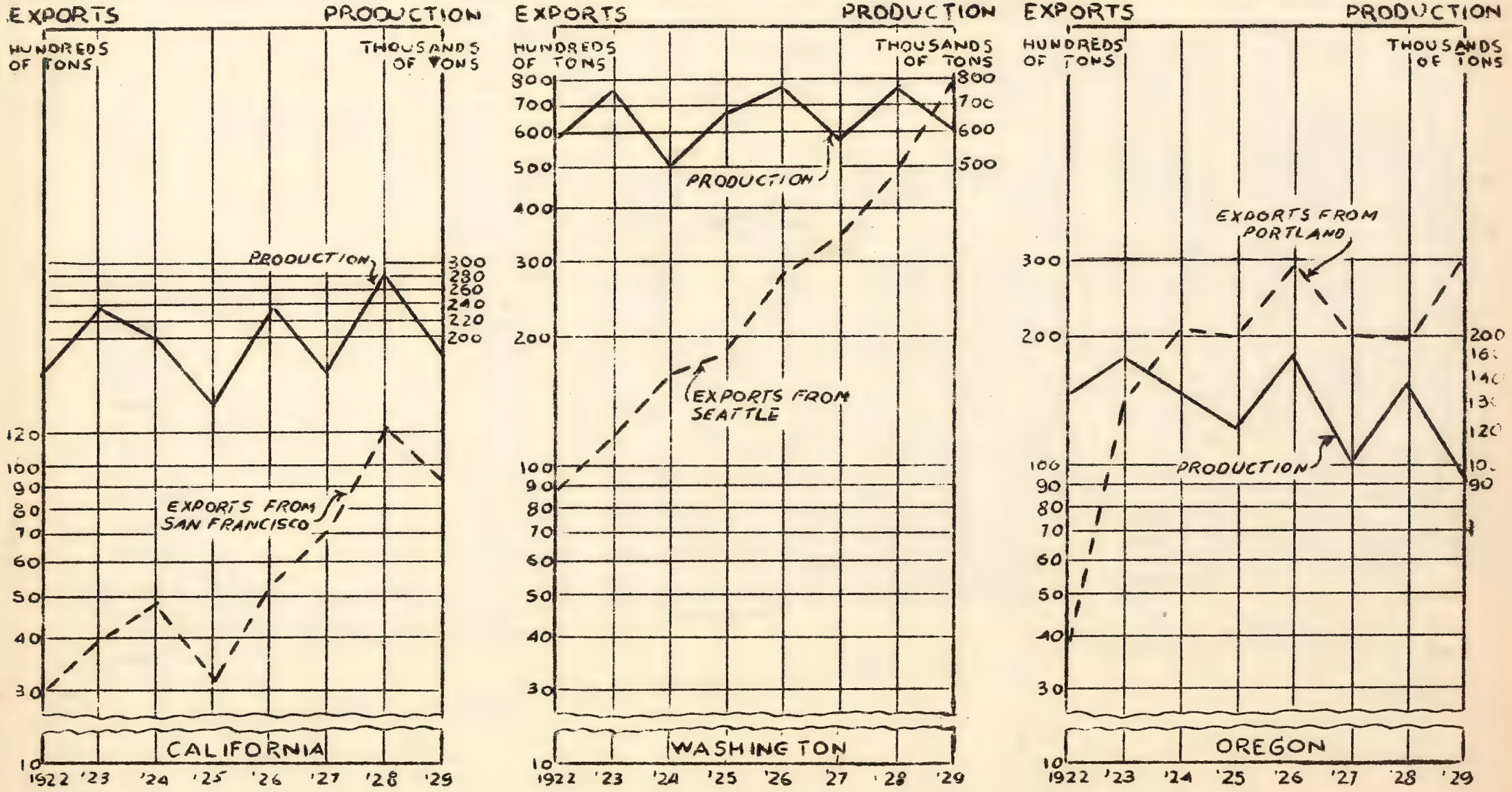


Fig. 5. The volume of apple exports from the various customs districts is dependent partly on the volume of production in the territory adjacent to the district, partly on the portion of the crop taken by local consumers, and partly on the volume shipped east.

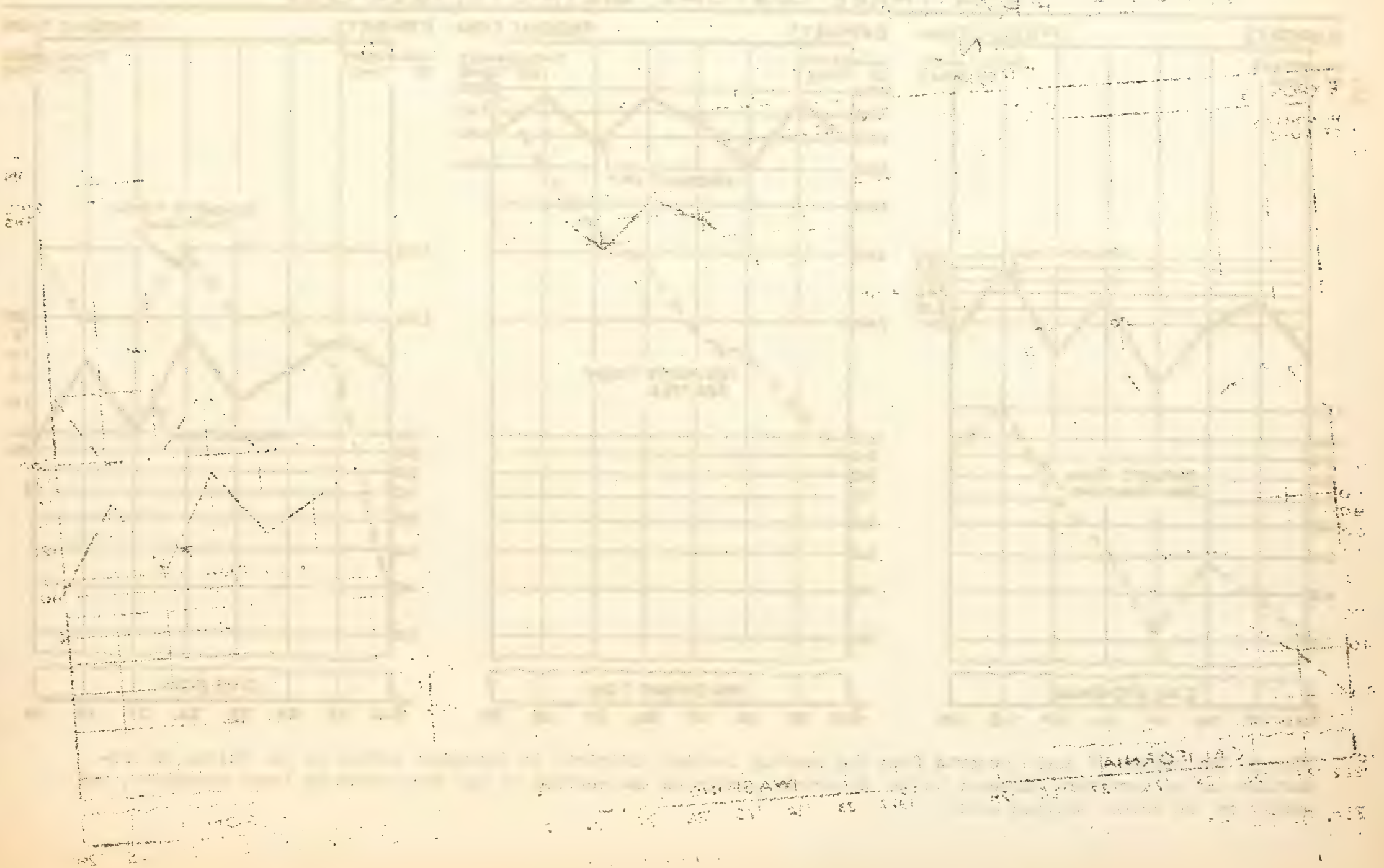


TABLE 3

PRODUCTION OF FRUIT IN CALIFORNIA (1922-1929)

In tons*

Fruit	1922	1923	1924	1925	1926	1927	1928	1929
Apples	176,625	236,250	200,317	135,360	232,875	167,805	276,345	173,250
Peaches	409,920	379,920	330,024	394,032	541,008	492,000	618,048	325,032
Pears	150,000	133,008	133,008	181,008	207,000	181,008	197,110	186,000
Plums and fresh prunes	480	690	390	510	710	570	660	390
Prunes	325,000	275,000	347,500	365,000	375,000	562,500	550,750	257,500
Apricots	145,000	210,000	142,000	150,000	176,000	208,000	175,000	195,000
Cherries	14,000	12,000	13,500	12,000	20,000	12,000	18,500	16,000
Grapes	1,806,000	2,030,000	1,535,000	2,050,000	2,129,000	2,406,000	2,366,000	1,751,000
(1) Total deciduous	3,027,025	3,276,868	2,701,739	3,287,910	3,681,593	4,029,883	4,202,413	2,904,172
Oranges	703,710	844,795	633,500	847,000	985,845	805,000	1,354,675	826,000
Grapefruit	11,820	10,890	11,610	18,000	19,500	21,600	24,000	29,160
Lemons	131,250	252,450	192,187	267,600	289,200	225,000	266,250	296,250
(2) Total citrus	846,780	1,108,135	837,297	1,132,600	1,294,545	1,051,600	1,644,925	1,151,410
Total (1) and (2)	3,873,805	4,385,003	3,539,036	4,420,510	4,976,138	5,081,483	5,847,338	4,055,582

* Computed from data furnished by Dr. S. W. Shear, Division of Agricultural Economics, University of California.

TABLE 4

PRODUCTION OF FRUIT IN WASHINGTON (1922-1929)

In tons*

Fruit	1922	1923	1924	1925	1926	1927	1928	1929
Apples	579,937	742,500	495,000	664,875	765,675	570,217	753,750	599,760
Peaches	18,528	22,800	32,992	11,040	20,880	29,328	6,000	35,280
Pears	41,760	64,800	42,000	55,200	77,280	40,080	88,800	67,200
Plums and fresh prunes	55	95	80	90	140	110	185	200
Cherries	6,000	8,000	4,000	7,000	9,000	3,000	8,500	7,500
Grapes	1,892	2,000	1,734	3,100	2,500	3,200	4,300	4,700
Cranberries	450	700	400	850	830	1,050	750	550
Total	648,622	840,895	575,204	742,155	876,305	646,985	862,285	715,190

*Computed from data furnished by Dr. S. W. Shear, Division of Agricultural Economics, University of California.

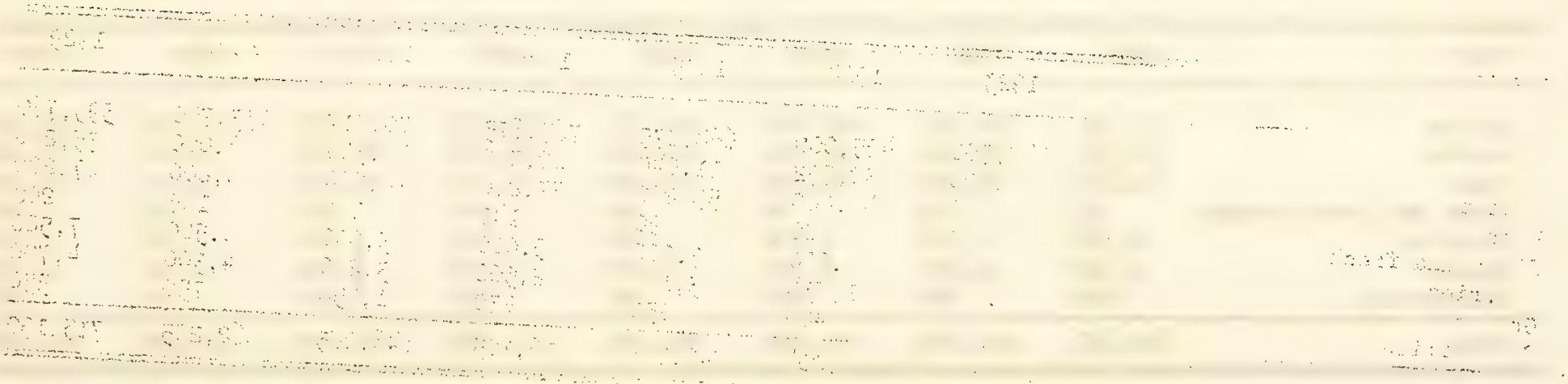


TABLE 5

PRODUCTION OF FRUIT IN OREGON (1922-1929)

In tons*

Fruit	1922	1923	1924	1925	1926	1927	1928	1929
Apples	141,750	180,000	146,250	121,500	180,810	97,200	156,375	90,000
Peaches	7,200	12,000	4,536	5,328	9,216	3,840	7,008	5,568
Pears	33,600	37,920	29,400	36,000	50,400	45,600	64,800	56,544
Plums and fresh prunes	120	210	90	110	190	190	216	280
Prunes**	90,000	62,500	62,500	32,500	112,500	50,000	15,000	91,000
Cherries	5,500	8,800	10,000	6,300	14,400	10,500	11,500	8,400
Grapes	1,530	1,365	1,333	1,500	1,800	2,025	2,025	2,116
Cranberries	120	85	100	225	350	300	300	250
Total	279,820	302,880	254,209	203,463	369,666	209,655	257,224	254,158

* Computed from data furnished by Dr. S. W. Shear, Division of Agricultural Economics, University of California.

**Includes Washington prunes.

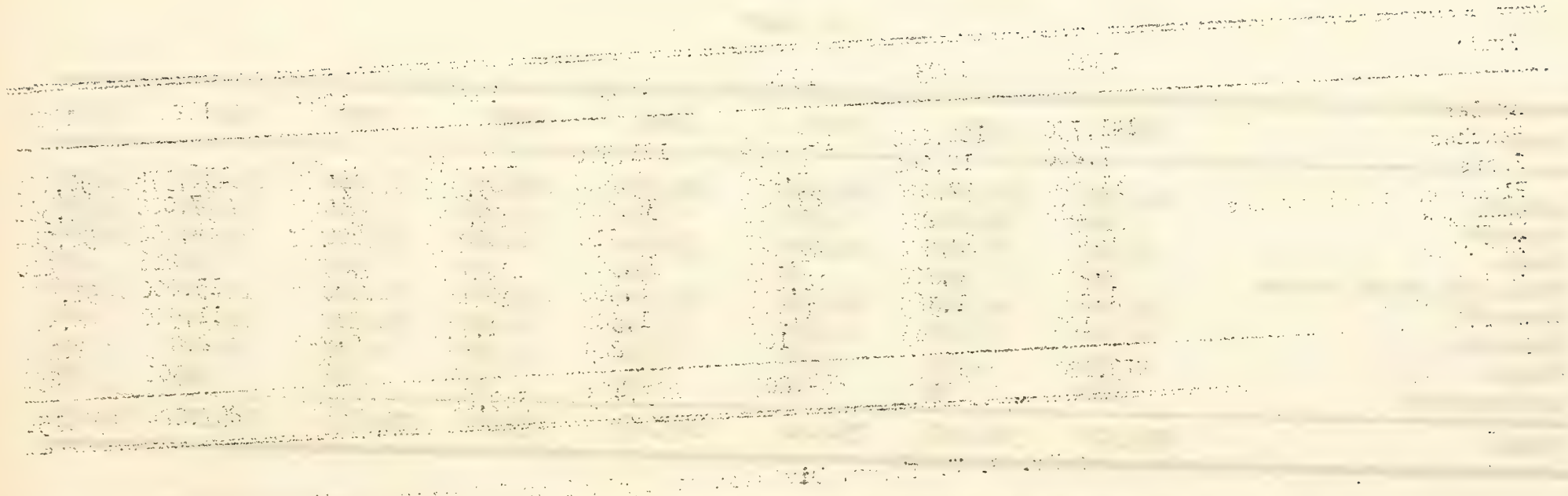


TABLE 6

COMPARATIVE COSTS IN SHIPPING APPLES FOR EXPORT

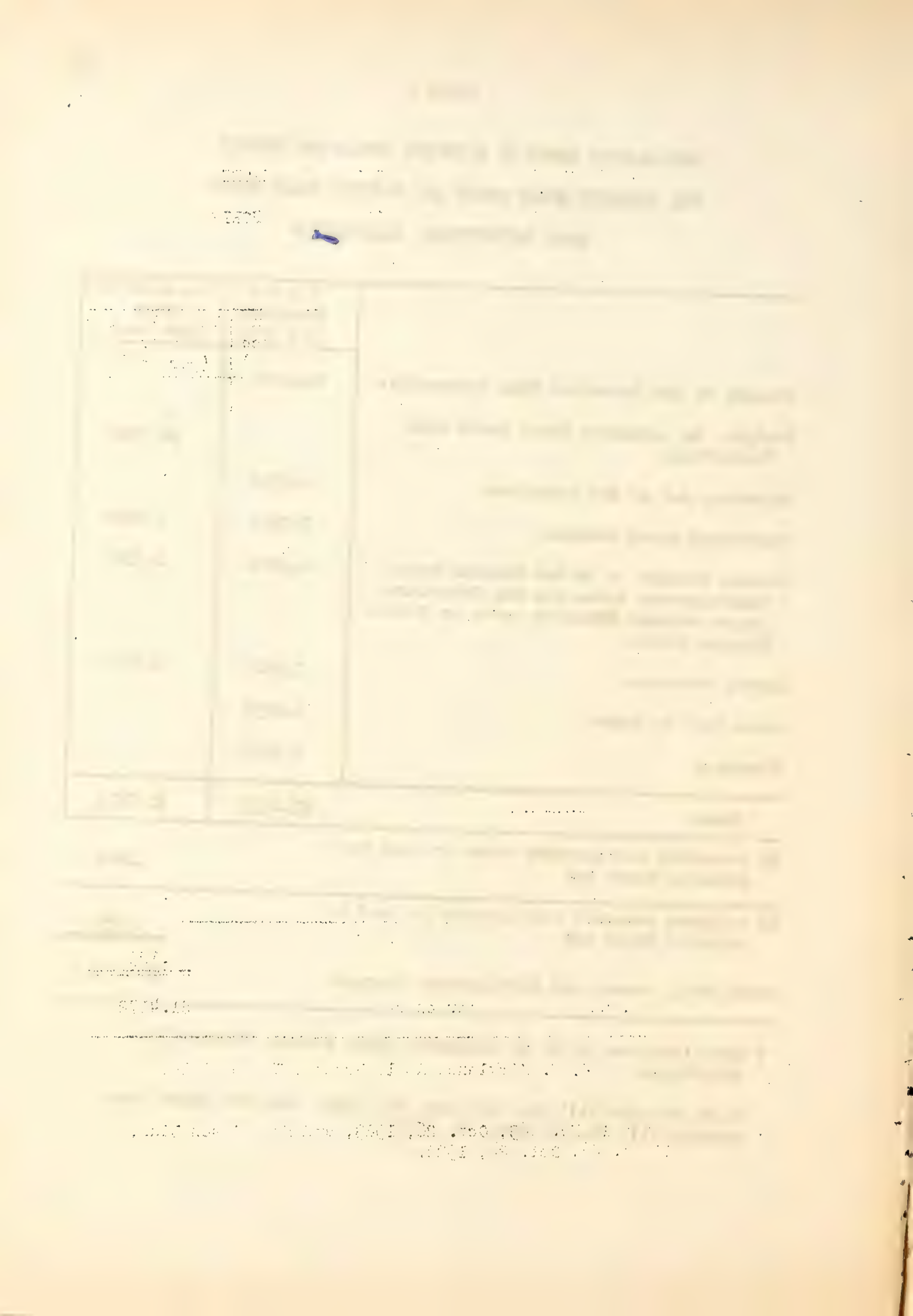
VIA ATLANTIC COAST PORTS AND PACIFIC COAST PORTS

FROM WATSONVILLE, CALIFORNIA*

	Via San Francisco (per box)	Via Atlantic ports (per box)
Freight to San Francisco from Watsonville	$0.0832	
Freight to Atlantic Coast ports from Watsonville		$0.7800
Unloading car at San Francisco	0.0150	
Forwarding agent charges	0.0066	0.0040
Steamer freight to United Kingdom ports (Refrigerator space via San Francisco; common storage Atlantic ports to United Kingdom ports.)	0.9000	0.3000
Marine insurance	0.0225	0.0075
State toll at docks	0.0036	
Clearance	0.0066	
Total	$1.0375	$1.0915
If steamship refrigerator space is used via Atlantic Coast add		.2000
If railroad standard refrigerator is used to Atlantic Coast add		.1257
Total rail, ocean, and refrigerator charges		$1.4172

* Data furnished by J. R. Kirkland, Apple Broker, Watsonville, California.

S. P. Freight bill No. 863, Oct. 26, 1929, and Fred Olsen Line, Freight bill No. 26, Oct. 24, 1929.



in the spring, and poultry. One of the large intercoastal lines expects to handle increasing quantities of lamb if a satisfactory method of hanging-up carcasses can be found.

Shipments of poultry and eggs via San Francisco both for export and domestic consumption are increasing, but according to Mr. John Lawler, Manager of the Poultry Producers of Central California, shipside refrigeration is not a factor in shipping poultry and eggs by water.

THE DEMAND FOR FRESH FRUIT FROM CALIFORNIA FOR EXPORT AND THE ORIGIN OF THIS FRUIT

The principal California fresh fruits entering the export trade are apples, pears, and citrus fruits (table 1). Exports of grapes have increased in recent years, but they represent an insignificant part of the California production. Plums have also been exported on a small scale, mostly to England. Europe is the principal export outlet for California fresh fruit, but Asiatic and South American markets are assuming more importance.

Quality and pack form the basis for the export market. The keen competition met in these markets from the fruit originating in other countries makes it impossible for California to compete on a low price basis. The expansion or even the maintenance of the present export trade in California fruits will depend in large measure upon further development of this reputation for high quality and the possibility of obtaining a premium for it.

California apple exports are confined to the Gravenstein and Newtown varieties. Since the Gravenstein is an early variety, it has a considerable advantage in European markets. Most of these apples are shipped by rail across the United States, since it is important to get them to Europe as early as possible. California Newtowns meet strong competition from Oregon Newtowns and from the Albermarle Pippins of Virginia in European markets. In recent years, Oregon Newtowns have brought a premium over the California varieties in British and Continental European markets. It does not appear that the foreign outlet for this variety can be greatly expanded in the face of this competition.

The outlet for pear exports is better than that for apples. California produces a large part of the United States supply and production appears to be increasing. Most of the California export pears go to England, but in some years Continental European markets take considerable quantities. Only a small quantity of the best-quality pears can be sold in European markets during the peak of the European pear season, which lasts from August to October. An export surplus of pears is produced by many European countries, among which are Belgium, France, the Netherlands, and a number of the central and eastern European countries. After the European pear season closes, however, there is usually a good outlet in Europe for pears from the United States. In February pears arrive in Europe from South Africa and compete with the late shipments from the United States. Upon the whole, it would seem that a considerable expansion in the export trade in California late pears might be anticipated, although the quantities

will vary greatly from year to year depending upon crop developments in the United States and in competing foreign countries.

There appears to be little prospect of building up a substantial export trade in California Navel oranges because of the keen competition from the large supply of low-priced oranges from Spain and Palestine. There will no doubt continue to be a fairly stable demand for the highest-quality California Navels in Europe, but the quantity exported will doubtless continue to be small relative to production. The outlook for the export of California Valencias is somewhat brighter, and in years of large crops and small sizes there doubtless will be substantial exports of these oranges during the summer months. Competition of South African and Brazilian oranges is, however, increasing and will have to be reckoned with in the future export trade of California Valencias.

There is a limited overseas market for California plums, principally in the United Kingdom. They must be sold in competition with continental European and home-grown British plums. The relatively low price of these competing plums makes it necessary for the California fruits to make their appeal on a quality basis.

The low prices prevailing on California grapes in recent years have led to the development of a small export trade. With the return of more normal prices, a curtailment of this trade is to be expected. European countries, particularly Spain, produce large quantities of table grapes of good quality which can be placed on the consuming markets of Europe much more cheaply than grapes from California. There would be a possibility of some expansion of California grape exports to Europe if they could be placed on the European market after the heavy movement of Spanish grapes ends in November. [2]

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2. Statement by L. A. Wheeler, Bur. Agr. Econ. through the courtesy of Asher Hobson, Foreign Agricultural Service Division.

A survey of Oriental markets shows that an increase of exports of fresh fruits is dependent upon extensive trade promotion and lower prices. B. H. Crocheron and W. J. Norton [3] report: "The active demand for American

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3. Crocheron, B. H. and W. J. Norton. Fruit markets in eastern Asia. California Agr. Exp. Sta. Bul. 493: 313. 1930.

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fruit in Asia is already supplied."

The origin of fresh deciduous fruits for export in California is principally from points in the San Joaquin and Sacramento calleys. Apple exports originate from the Watsonville and Sebastopol districts. Citrus fruit shipments, however, originate principally south of the Tehachapi. Each port tends to attract the export shipments from its natural trade territory, hence San Francisco may not expect to capture the business of other ports by expansion of harbor facilities. Mr. Ralph Koerber, Director of Research of the San Francisco Chamber of Commerce, has made an exhaustive study of this phase of exporting. The breaking points in the freight-rate structure tend to define the trade areas for the various Pacific Coast ports.

TABLE 7

REFRIGERATOR SPACE IN VESSELS SERVING SAN FRANCISCO *

Destinations	Operating line	Number of vessels	Tons of refrigerator space**
United Kingdom and Europe	Holland-American & Royal Mail	15	73,782
	Hamburg-American Line	5	9,747
	Furness Line	12	42,225
	North German Lloyd	5	8,930
	Johnson Line	3	3,578
	Fred Olson Line	4	6,750
	Donaldson Line	6	13,250
	Blue Star Line	12	100,521
	French Line	5	2,134
	East Asiatic Company	1	1,750
Orient	Dollar Line & American Mail Line	19	7,883
	Kerr S.S. Co.- "Silver Fleet"	13	14,900
	Nippon Yusen Kaisha	7	1,680
	Oceanic and Oriental Line	3	750
	Klaverness Line	1	1,250
	Osaka Shosen Kaisha	14	4,919
	Canadian Pacific	4	1,949
	Mitsui Line	2	1,350
	Barber Line	5	3,750
	Bank Line	2	680
East Coast of South America	McCormick Line	5	1,875
	Blue Star Line		Counted above -
	Westfal-Larsen Line	4	6,000
West Coast of South America	Grace Line	5	735
	Knutsen Line	3	3,750
	Latin America Line	1	300
Central America	Panama Mail S.S. Co.	2	300
	United Fruit Company	5	9,500
Hawaii	Los Angeles S. S. Co.	4	1,505
	Matson Navigation Co.	12	3,254
	Dollar Line		Counted above -
	Canadian Australasian Line		Counted above -
Australasia	Matson Navigation Co.	7	1,870
	Union S.S. Co. of New Zealand	3	840
	Canadian Australasian Line	3	4,550

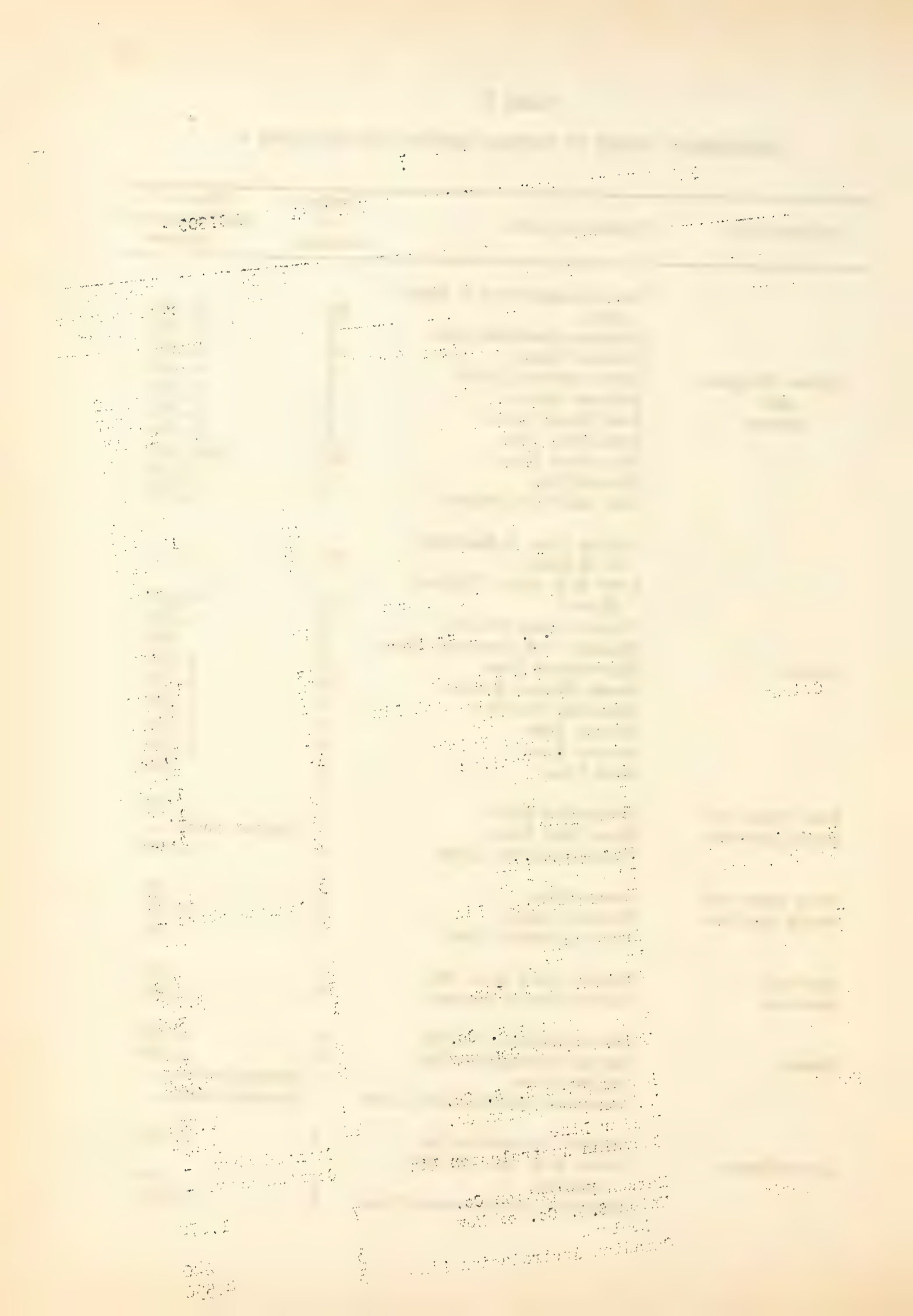


TABLE 7 (con.)

Destinations	Operating line	Number of vessels	Tons of refrigerator space**
Mediterranean	Navigazione Libera Triestine	5	1,550
Alaska	Pacific S. S. Co. (Admiral Line)	5	546
	Alaska S. S. Co.	7	788
Intercoastal	Panama Pacific	3	5,400
	Dollar Line		Counted above -
	Total all lines	217	414,546

* Data compiled from Pacific Shipper, Supplement iv. Aug. 18, 1930.

**In measurement tons of 40 cubic feet.

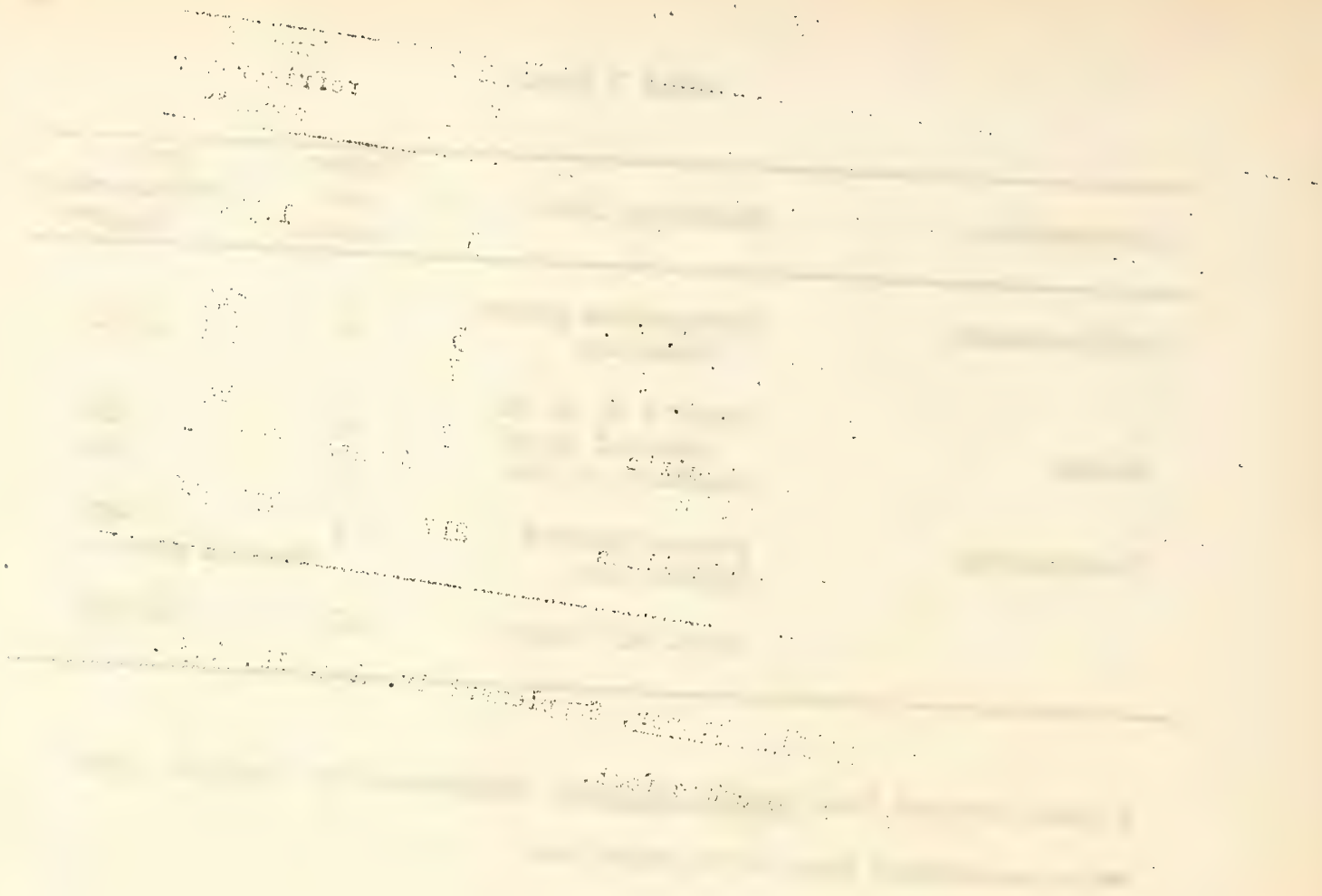


TABLE 8

PORTION OF OUT-BOUND REFRIGERATOR SPACE

FILLED, SAN FRANCISCO, JUNE 15 TO OCTOBER 15, 1930

Destination	Refrigerator space on which records were taken (tons#)	Portion of space filled* (per cent)
The Orient	18,846	53
United Kingdom and Europe	15,473	54
Hawaii and Australasia	7,629	46
Central America	19,309	20**
East Coast of South America	1,725	75

* Computed from ship engineer's estimate of portion of refrigerator space filled when each vessel sailed.

**Includes the out-bound shipments of the United Fruit Company's vessels.

In measurement tons of 40 cubic feet.

However, shipments are sometimes made via ports other than the port of the trade area because ships bound for certain foreign ports do not call at all Pacific Coast ports. Mr. L. M. King, Traffic Manager of the Board of State Harbor Commissioners, made careful investigation of this matter and reported that this was the reason given by shippers making such shipments.

REFRIGERATOR SPACE AVAILABLE IN SHIPS CALLING AT CALIFORNIA PORTS

Table 7 shows the refrigerator space in the ships calling at California ports adaptable for shipments of perishables. However, not all this space is available to California shippers, because a part is occupied by shippers from other Pacific Coast ports.

Many of the steamship companies now operating in the San Francisco harbor plan to equip their vessels with refrigerator space. According to a survey made by the Pacific Rural Press, 30 vessels are now being equipped with refrigerator space. This will add a total of 32,970 tons of space.

The portion of the refrigerator space utilized by steamship companies varies with the season of the year and the foreign ports of call (see table 8). The Kerr Steamship Company and the Oriental and Oceanic Steamship Company report considerable space empty, but they usually have enough cargo in one of the holds to make it pay to run the refrigeration machinery. In the European trade, refrigerator space is often booked ahead to capacity through the fall and winter.

PRESENT STORAGE AND REFRIGERATION FACILITIES IN NORTHERN CALIFORNIA

Table 9 shows the amount and location of cold-storage space in northern California. Many of the plants are filled to capacity at certain seasons of the year. However, some are never taxed to capacity. Cold-storage houses in San Francisco are prepared to take care of unusual peak loads of all commodities. Their average occupancy does not exceed 60 or 65 per cent, according to the report of M. H. Robbins on Shipside Cold Storage.

The State Products Terminal for shipside refrigeration is located on China Basin in the original State Products Terminal Building (or China Basin Terminal) directly across the Embarcadero from Piers 44 and 46 and between Third Street and the Embarcadero (the two main arteries of harbor traffic). According to information furnished by the State Board of Harbor Commissions, the following information pertains to the State Products Terminal:

Dimensions of the State Products Terminal Building:
First floor - 812' x 135'
Second floor - 812' x 102'

Dimensions of the State Cold Storage Plant:
Second floor 264' x 102'

Cargo or storage capacity of the State Cold Storage Plant:
(Using apples as a basis)
3,000 tons
90,000 boxes
or, 210,000 cubic feet

Dimensions of the cold storage rooms:

32 x 80	44 x 80	40 x 44
33 x 80	64 x 80	40 x 44
33 x 50		

The brine circulation system of refrigeration has been installed.

The plant is equipped with a fixed type of ozonizer for taking care of humidity and atmospheric conditions which obtain in storage rooms where large quantities of fruit are in storage.

The plant is equipped with a large Otis (automobile) elevator with a capacity of 6 tons at 60 feet per minute.

Spiral chutes have been installed in the corridors adjacent to the shipside of building to facilitate loadings from the ground floor.

The floor, walls, and pillars are covered with 4-inch cork, while the ceiling is lined with 5-inch cork. The rooms are protected with heavy refrigerator doors, auxiliary to which are swinging inside doors to prevent loss of temperatures in storing and shipping.

The building is 40 feet from bulkhead or 65 feet from the center of the hatch of the average ship.

The depth of water at bulkhead is 35 feet below mean water and 48 feet below the deck of pier.

The length of the loading platform at shipside will be 103 feet.

Maximum berthing space available including emergency space at Piers 44 and 46 is 3,200 feet. Measured from the center of the warehouse to center of berth there are: - 1 berth at 240 feet, 1 berth at 310 feet, 1 berth at 610 feet, 1 berth at 740 feet, and 1 berth at 790 feet.

The receiving platform is sawtoothed to permit trucks to back to the receiving doors and within 10 feet of the storage rooms.

A long concrete ramp leads from the Embarcadero and Berry Street to the receiving platform, making it possible to unload trucks on second floor of building.

Depressed double tracks run the full length of the building, providing space for 60 cars.

All equipment is so installed as to permit the doubling of capacity throughout in a very short period of time. The machinery of the engine room is now capable of double the present refrigeration requirements.

TABLE 9

COLD-STORAGE SPACE IN NORTHERN CALIFORNIA

Location	Number of plants	Capacity (cubic feet)
Santa Rosa	1	50,000
Sacramento	2	630,000
Fresno	2	266,000
Bakersfield	1	149,000
San Francisco (private)	2	5,000,000
San Francisco (state)	1	210,000
San Luis Obispo	1	50,000
Modesto	1	220,000
Atascadero	1	150,000
Napa	1	72,000
Lodi	1	24,000
Chico	1	22,000
Santa Cruz	1	52,000
Mountain View	1	65,000
Stockton	2	1,165,000
Oakland	2	1,025,000
Petaluma	1	800,000
Watsonville	3	2,580,000
San Jose	3	1,375,000
Total	28	13,905,000

The building is of reinforced concrete and practically new insofar as construction is concerned. The structure is capable of almost unlimited development as a waterfront cold storage terminal. The conversion of the second floor alone into cold storage rooms would produce 210,000 cubic feet for each of the three sections or 630,000 cubic feet for the entire second floor. The foundations and lower floors of this building are designed to carry four additional floors, so that the capacity, in case only the easterly section is completed, would total 850,000 cubic feet, and in case all three sections of the building were completed in cold storage rooms, would total over 2,500,000 cubic feet.

TRANSPORTATION AND STORAGE RATES

Railroad transportation costs, except for very short local hauls, are the same to San Francisco and Oakland. Some few years ago the Oakland Chamber of Commerce requested that the Interstate Commerce Commission and the California Railroad Commission grant lower rates to Oakland than are quoted for San Francisco. This request was denied on the basis that San Francisco was the original point on the Bay to obtain terminal rates.

Switching, ferry, and cartage charges from points of production to San Francisco via Oakland are absorbed by the carriers. Consequently, from a freight-rate standpoint, Oakland and San Francisco are equally suitable as points of storage.

Cold-storage companies in San Francisco now absorb the cartage charges from storage to shipside because of the competition of the State Products Terminal. Cold-storage absorption tariff ruling of the California Railroad Commission provides: "The absorption herein provided is intended as an experiment ... in the precooling and cold storage of perishable products at California points, in competition with direct shipside delivery from point of production, and the provisions herein do not apply on merchandise shipped by water to ports beyond storage point."

Cold-Storage Rates in California and Eastern Cities.- Cold-storage rates for various fresh fruits in several California cities and several eastern cities are shown in table 10. Cold-storage rates in California, Minnesota, and one or two southern states are regulated by public utilities commissions of the states, but rates in other states are subject to bargain in the same way as prices for other commodities and services and as open steamer freight rates. In view of this situation it is difficult to make comparisons of storage rates, for it is reported that departures from the published tariffs by cold-storage warehouses located in nonregulated states are not infrequent. It is also reported by those using the storages that this practice prevails regarding services which are listed as extra costs in the tariffs but which in practice are often absorbed in the quoted commodity rates. Certain published tariffs in nonregulated states specifically mention that car unloading on straight cars is absorbed in the regular handling charges. This is also the practice in California, but in California charges for car loading are universally made. On the other hand, the tariffs

TABLE 10

NOMINAL COLD-STORAGE RATES IN VARIOUS CITIES IN THE UNITED STATES ON LARGE LOTS, USUALLY CARLOADS, AS PREVAILING OCTOBER 31, 1930 *

City	Unit	Rate for first month (cents per unit)	Rate for succeeding month (cents per unit)	Rate for season (cents per unit)
		Apples		
California cities except those listed below	Box	9	5	25#(to June15)
Stockton, Lodi, Sacramento, Atascadero, Fresno, Calif.	"	9	6	25 (to June15)
Santa Rosa, Calif.	"	10	8	25 (to Mar. 1)
Marysville, Calif.	"	8	8	25 (to Apr. 1)
Minneapolis, Minn.	"	5	5	15 (to May 1)
Toledo, Ohio	"	6	6	25"(to Apr.1)
Chicago, Ill.	"	9	6	20
Omaha, Nebr.	"	9	6	20
Boise, Idaho	"	9	6	20 (to Apr.1)
New York, N. Y.	"	10	5	
Jersey City, N. J.	"	10 ϕ	5	
Boston, Mass.	"	5	5	25 (to Apr.1)
New Orleans, La.	"	6	6	
Cincinnati, Ohio	"	8	5	20 (to Apr.1)
St. Louis, Mo.	"	8	4,4,2,2,2	22 (6 mos.)
Philadelphia, Pa.	"	9	6	
Kansas City, Mo.	"	5	4,4,2,2,1	18 (6 mos.)
		Pears		
California cities except those listed below	Box	9	5	25 (to June15)
	One-half box	7	5	25 (to June15)
	Lug	7	5	25 (to June15)
Stockton, Lodi, Sacramento, Atascadero, Fresno, Calif.	Box	9	6	25 (to June15)
San Jose, Calif.	"	12	6,5,4,4,4	
Santa Rosa, Calif.	"	11	5	
Marysville, Calif.	"	8	8	25 (to Apr.1)
Minneapolis, Minn.	"	5	5	16 (to May 1)
Toledo, Ohio	"	8	6	
	One-half box	6	4	
Chicago, Ill.	Box	10	7	25 (to Apr.1)
	One-half box	6	4	15 (to Apr.1)
Memphis, Tenn.	Box	9	6	20
Omaha, Neb.	"	6	6	25
	One-half box	7	5	

TABLE 10 (con.)

City	Unit	Rate for first month (cents per unit)	Rate for succeeding month (cents per unit)	Rate for season (cents per unit)
Pears (con.)				
Jersey City, N. J.	Box	10	5	21
	One-half box	7	3½	15
Newark, N. J.	Box	6	6	
Boston, Mass.	"	15	5	25
	One-half box	10	4	20
New Orleans, La.	Box	6	6	
Cincinnati, Ohio	"	8	5	20 (to Apr. 1)
	One-half box	7	4	20 (to Apr. 1)
St. Louis, Mo.	Box	8	4,4,4,2,2	22 (6 mos.)
Philadelphia, Pa.	"	9	6	
Kansas City, Mo.	"	5	4,4,4,2,1	20 (6 mos.)
Grapes (in sawdust)				
				Third month and after
California cities except those listed below	Box-up to 32#	8	6	4
	" " " 36#	9	7	4
	Chest-up" 50#	12	8	5
	Keg or drum-50#	14	10	6
San Diego, Calif.	Box-up to 40#	10	7½	
	Keg - 50#	15	10	6
Minneapolis, Minn.	Lugs	9½	5	5
	Keg	14	8	8
Toledo, Ohio	Lug	6	4	4
	Keg	20	15	15
Chicago, Ill.	Lug	7	5	5
	Keg or drum	12	8	8
Memphis, Tenn.	Lug	5	5	5
	Keg	10	10	10
Omaha, Nebr.	Lug	7	5	5
	Keg or drum	10	6	6
New York, N. Y.	Lug	8	6	6
	Keg	15	12	12
Jersey City, N. J.	Lug	7	5	5
	Keg	15	12	12
Boston, Mass.	Lug	6	4	4
	Keg	12	7	7
New Orleans, La.	Lug	6	6	6
	Drum	10	10	10
St. Louis, Mo.	Lug-up to 46#	7	6	6
	Keg	10	6	6
Philadelphia, Pa.	"	12	10	10
Kansas City, Mo.	Lug	7	5	5
	Drum	12	8	8

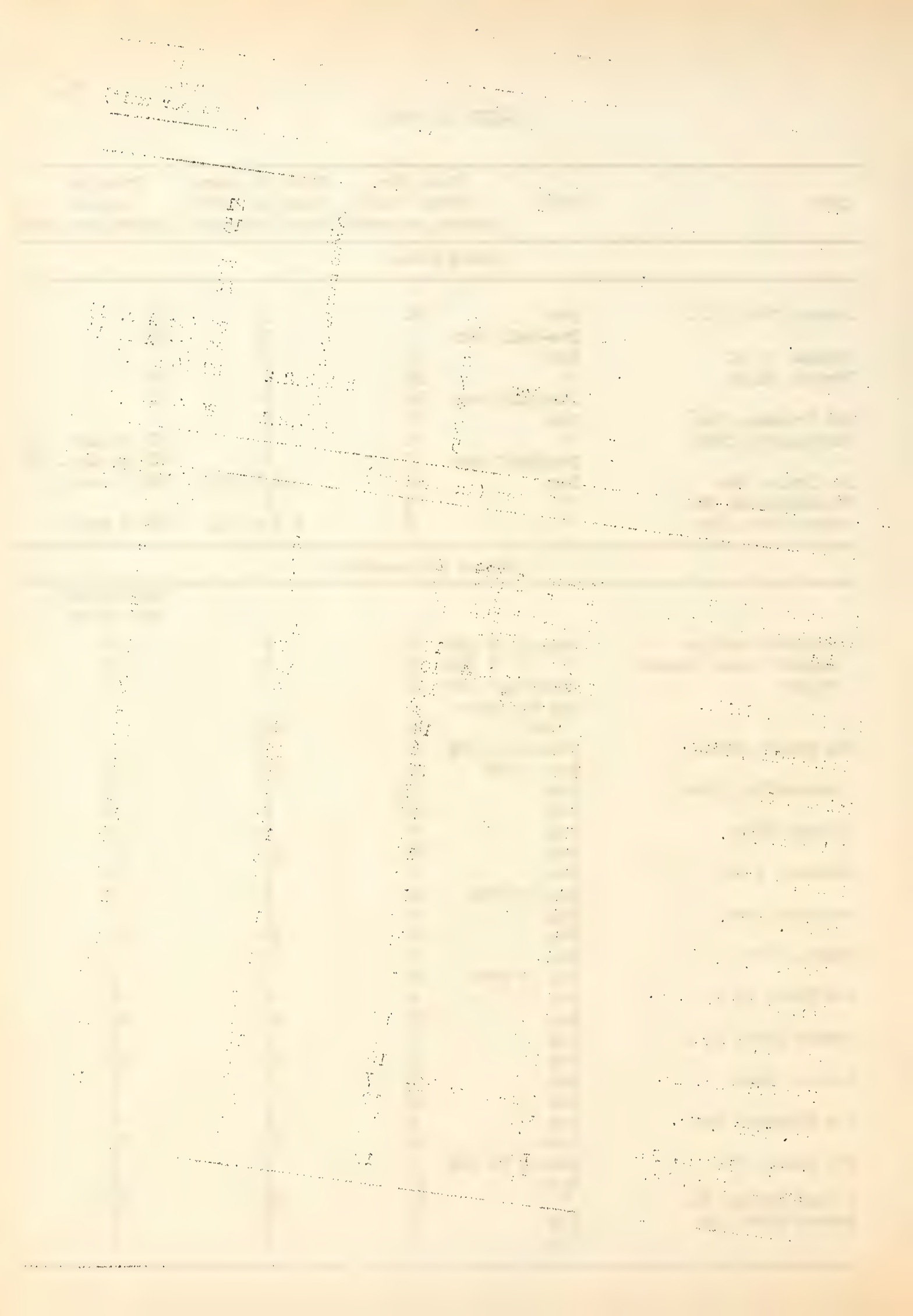


TABLE 10 (con.)

City	Unit	Rate for first month (cents per unit)	Rate for succeeding month (cents per unit)	Rate for season (cents per unit)
		Peaches		
San Francisco and Oakland, Calif.	Box or crate, 25# or less	7½	5	
Los Angeles, San Jose, Riverside, and San Bernardino, Calif.	L.A.lug	7	5	
Atascadero, Calif.	L.A.lug	8	6	
Fresno, Calif.	" "	9	6	
Stockton, Calif.	Crate or box per 100# net	37½	25	
Minneapolis, Minn.	Flat-30#	12	6	
Toledo, Ohio	Lug-25#	7	5	
Chicago, Ill.	Box-up to 2 cu. ft.	15	10	
Omaho, Nebr.	Crates	2½	2½	

* Data obtained from California Railroad Commission Bulletins, published rates of various cold storage companies, L. A. Bailey, Soc'y Pacific Coast Warehousemen's Association, and F. W. Read, California Fruit Exchange. Nominal rates are not necessarily the effective rates, because in some cases the rates include unloading and loading and material, while in other cases separate charges are made for these services.

\# Watsonville storage houses have a special season rate of 20 cents a box on apples, stored loose in boxes.

" Toledo has a special season rate of 20 cents a box on apples if 15 carloads are received from one customer.

ϕ Quantity discount of 10 per cent on lots of 25 carloads or more stored in transit.

for Minnesota warehouses specifically include car unloading and loading charges in the regular handling charges.

The cold-storage rate for fresh apples in standard western apple boxes in most California cities is 9 cents a box for the first month, and 5 cents a month thereafter, with a seasonal rate up to June 15 of 25 cents. This applies to lots of 300 boxes or more, as shown in table 10. On smaller lots the rate is a cent or two higher. The seasonal rate applies as soon as the sum of the monthly rate equals it. This rate is uniform in San Francisco, Oakland, Los Angeles, Long Beach, and the area surrounding Los Angeles as far as Riverside, San Diego, San Jose, Watsonville, Eureka, and Yucaipa. In Sacramento, Fresno, Stockton, and Atascadero, the rates are the same except that the rate for the second month and thereafter is 6 cents, and in Santa Rosa the rate for the first month is 10 cents.

The 1930 rates on apples in New York are 10 cents the first month and 5 cents a month thereafter. The rates in Toledo, Ohio, are 6 cents a month with a seasonal rate of 25 cents, but in case 15 carloads are stored by one customer the seasonal rate is 20 cents. A large cold-storage warehouse at Cincinnati which advertised for in-transit business quotes rates for the first month of 8 cents, 5 cents a month thereafter, and 20 cents for the season to April 1. In Chicago, the rates are 9 cents the first month, 6 cents a month thereafter, and 20 cents for the season.

It is evident that some eastern cities have lower nominal storage rates on apples than California cities, while the rates in other eastern cities are comparable. The midwestern cities which have a large volume of in-transit storage have in general somewhat lower rates than California cities. A comparison of rates on other products, such as pears, shows the same situation to prevail (table 10). However, as was noted above, eastern rates are subject to bargain, as with open steamer freight rates, while California rates are filed with the Railroad Commission, must be published, and cannot be changed without permission and 30 days' notice.

The matter of storage rates is important to California shippers and to California cold-storage houses. Other things being equal, shippers will store where rates are lowest, and points that have unfavorable storage rates lose business. According to F. W. Read of the California Fruit Exchange, the present rates obtainable in eastern cities handicap expansion of cold-storage business in California, unless the differences in costs are compensated by increased efficiencies, as is the case in some of the better plants of the state.

Storage-in-transit Privileges.- Not only are the storage rates important, but the storage-in-transit privileges are important in determining where shippers will store their products. In-transit privileges at points in California are accorded to shipments of perishable commodities by the railroads as set forth in Pacific Freight Tariff Bureau Tariff No. 184-B. These privileges are accorded to apples, pears, grapes, and persimmons. For example, in case a car of apples is sent from Watsonville to San Francisco, the shipper may request in-transit storage privileges, at no cost, and not binding. A bill of lading is filed with the cold-storage warehouse in San Francisco, which stores the goods. The shipper can then sell the apples in the local market, ship them out by ocean steamer, or ship east at some future date.

If he sends them east by rail, he pays the rate from Watsonville to the east less what he has already paid on the local rate to San Francisco, plus a charge of 6 cents per hundred pounds for the storage-in-transit privilege.

In order to take advantage of the storage-in-transit privilege provided for by Tariff 184-B, goods must move in carload lots and be stored in transit only at points directly intermediate between points of origin and transcontinental points via an authorized route. A number of through routes or "gateways" are listed in the Railroad Tariff and in the Equalization Clause in Rule 10 of Section 1 of this Tariff. Points in California which are intermediate to any authorized route may be points for storage in transit. To illustrate: Apples from Sebastopol moving directly east over the Southern Pacific would not go to San Francisco, but would turn off at Santa Rosa. However, there is an authorized route from Sebastopol via San Francisco because San Francisco is an interchange point for freight off the Northwestern Pacific going transcontinental via Western Pacific. The equalization clause referred to permits storage in transit at San Francisco in cases where the Southern Pacific handled the shipment east. Otherwise goods would be forced from the Southern Pacific to competing lines or interchange points in certain cases, or else the goods could not be stored on the in-transit privilege.

Exception is made as provided by Exception 1, Rule 10, of Section 1, that grapes may be stored at certain points off the authorized through routes for an extra charge of $15.00 a car in addition to the regular in-transit privilege charge of 6 cents per 100 pounds. Thus grapes from virtually all points of California, even as far south as San Diego County, for example, may be stored in San Francisco and then shipped transcontinental for the through rate from San Diego to the transcontinental destination plus the in-transit charge of 6 cents per 100 pounds, and a charge of $15.00 a car.

There is no provision in railroad tariffs for out-of-line storage of any California commodity except grapes. Railroad men state the reason is because there has never been any demand for such out-of-line storage of any commodity except grapes, which at harvest time exceed the capacity of the cold-storage warehouses at interior points on direct authorized routes.

However, a special section, Section 2, of Tariff 184-B, provides that pears from the Northwestern Pacific may be stored in San Francisco, processed to retard ripening, and repacked, on the 6 cents per 100 pounds transit charge, and then be shipped on the through rate from point of origin, with the local rate from point of origin to San Francisco entirely rebated.

Even should the out-of-line privilege at present provided for in the case of grapes be extended to include apples and pears, there is still a differential of $15.00 a car against out-of-line storage at San Francisco. This charge of $15.00 a car would appear to hinder any extensive seaboard storage in transit for goods which may later be routed to overland transcontinental markets. Under the present rate structure Sacramento seems to be the logical center for the development of storage in transit for fresh fruits originating at Valley points and destined for transcontinental shipment. However, should fruit stored in Sacramento later be destined for ocean shipment, the combined local rates from point of origin to Sacramento and from Sacramento to seaboard would undoubtedly be much higher than the

local rate from point of origin directly to seaboard. As a result, so far as present railroad rates, cold-storage charges, and storage-in-transit privileges are concerned, the most practicable point for storage of fruit which may be destined for export at Pacific Coast ports, for domestic consumption, or for transcontinental shipment, is in cold-storage houses close to the point of origin.

Storage-in-transit privileges are in force in eastern centers. For example, one can ship a car of apples to Kansas City and store them for a period. Then if a buyer is found further east, one can ship the apples to him by paying the rate from Watsonville to the eastern destination, less the Watsonville to Kansas City rate which had already been paid, plus the charges for the in-transit privilege, and possibly an out-of-line charge in certain cases. These in-transit privileges and out-of-line haul charges are variables depending upon the point where storage in transit is effected and the amount of extra mileage of total haul, due to out-of-line movements, as compared with the straight haul from origin to final destination.

These storage-in-transit privileges in eastern cities also tend to check cold-storage development in California. It is often advantageous to have fruit definitely destined for eastern shipment stored in the eastern centers in order that shippers may without delay take advantage of stronger markets in these centers. If fruit is stored in California the opportunity of taking advantage of a strong market may be past before the fruit can be placed in those markets.

Storage in transit should not be confused with diversion in transit. In the former the goods are unloaded and stored for a period, while in the latter terminal destination for a car is chosen as it rolls east on a bill of lading with an open destination.

THE TRANSPORTING OF FRUIT TO SHIPSIDE AND THE CONDITIONS UNDER WHICH IT IS HANDLED AND LOADED FOR EXPORT

During the four-month period June 15 to October 15, 1930, a daily survey was made of a number of docks on the San Francisco harbor to determine as accurately as possible how fruit destined for export arrived at shipside, how it was handled on the docks, and the temperatures under which it left port. Data were obtained on 541 shipments which probably represents three-fourths of the total shipments made during this period.

Method of Transportation to San Francisco.- The data obtained show that the larger proportion of the early and more perishable fruits, such as cherries, apricots, peaches, nectarines, and plums received from the Sacramento and San Joaquin valleys and adjacent foothills for export, arrived in San Francisco by truck. This means of transportation is also important with pears, apples, and grapes, but throughout the entire shipping season rail shipments of these fruits are more important. Boat shipments are of less importance than those shipped by railroads or truck lines, although some shipments of early fruit from the Loomis-Newcastle area, Sacramento River points, Napa, Santa Rosa, and Healdsburg districts arrive in San Francisco by water. Table 11 shows the relative number of shipments noted arriving by each of these methods.

TABLE 11

METHODS EMPLOYED IN TRANSPORTING DECIDUOUS FRUITS TO THE PORT OF SAN FRANCISCO, JUNE 15 TO OCTOBER 15, 1930

Fruit	Number of shipments observed	Percentage of shipments arriving by		
		Truck	Rail	Boat
Cherries	11	36	64*	0
Apricots	11	91	9	0
Peaches and nectarines	55	55	43	2
Plums	103	51	46	3
Pears	69	38	61	1
Apples	145	41	56	3
Grapes	147	48	56	0

*All rail shipments of cherries noted were from Oregon. Truck shipments only from California.

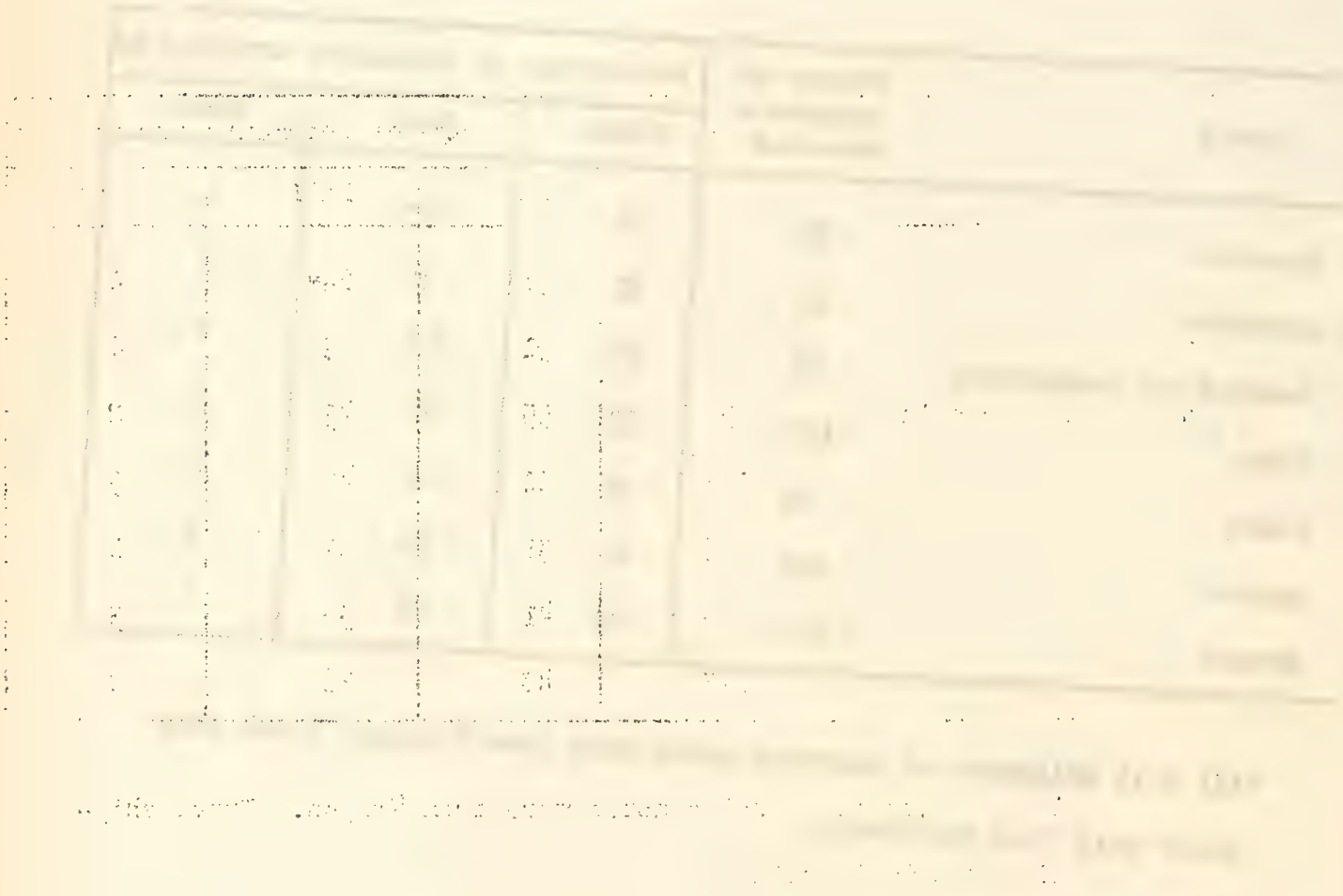
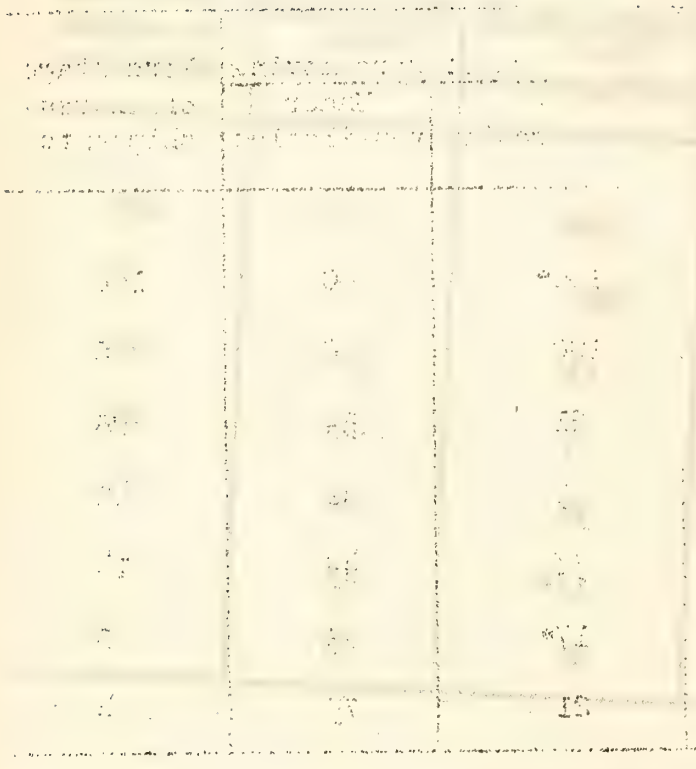


TABLE 12

RAIL SHIPMENTS MOVING TO SAN FRANCISCO UNDER VENTILATION AND UNDER REFRIGERATION

Fruit	Number of rail shipments observed	Percentage of cars moving		Percentage of express shipments
		Under refrigeration	Under ventilation	
Cherries	7	100*	0	100
Apricots	1	100	0	0
Peaches and nectarines	24	21	54	25
Plums	47	9	42	49
Pears	42	38	48	14
Apples	82	17*	83	0
Grapes	78	21	75	4

* All of this fruit from Oregon and Washington.



All fruit arriving by truck and by boat is nonrefrigerated. Segregating the data for the total movement of fruit by rail, as shown in table 12, it is evident that the greater number of shipments moving by rail are also carried in noniced cars. Cherries from Oregon, usually expressed, apples from Washington and Oregon, and an occasional car of peaches from the Northwest are received under ice. Aside from these out-of-state shipments, fall and winter pears from the Santa Clara Valley are probably the most important deciduous fruit arriving under refrigeration. Seventeen cars of citrus from the southern part of the state were noted during the above four-month period, all of which were reported as having arrived in iced cars.

Time between Harvesting and Shipping.- The rapidity with which fruit is handled is extremely variable, and depends both on the individual grower and on the kind or variety of fruit. The more perishable deciduous fruits, such as cherries, apricots, peaches, and plums, should be, and are to a large extent, picked, packed, and loaded within a 15-hour period. There are, however, numerous instances during the rush of the season when such fruits are not shipped until the day following picking. Pears and apples may be handled as quickly as stone fruits. On the other hand, the time elapsing between picking and loading (or storage) of the later varieties is not infrequently two to three days. Grapes, formerly allowed to 'wilt' for 24 hours before packing, are now in large part packed and loaded in cars or on trucks within 12 hours. In fact some large growers pride themselves on having their fruit loaded within 2 to 3 hours after it is picked.

When growers know in advance that a certain lot of fruit is destined for immediate export, some effort is usually made to handle this particular lot with minimum delay. The more discriminating exporters now specify that the softer fruits for export from San Francisco on any certain day be not picked until the day previous. They desire that such fruits be delivered at shipside on the morning of sailing. This practice, however, represents somewhat more of an ideal situation than which under present shipping conditions always seems practicable. On the contrary, in filling of small orders, numerous exporters purchase fruit on the open market. Such orders involve extra handling and delay.

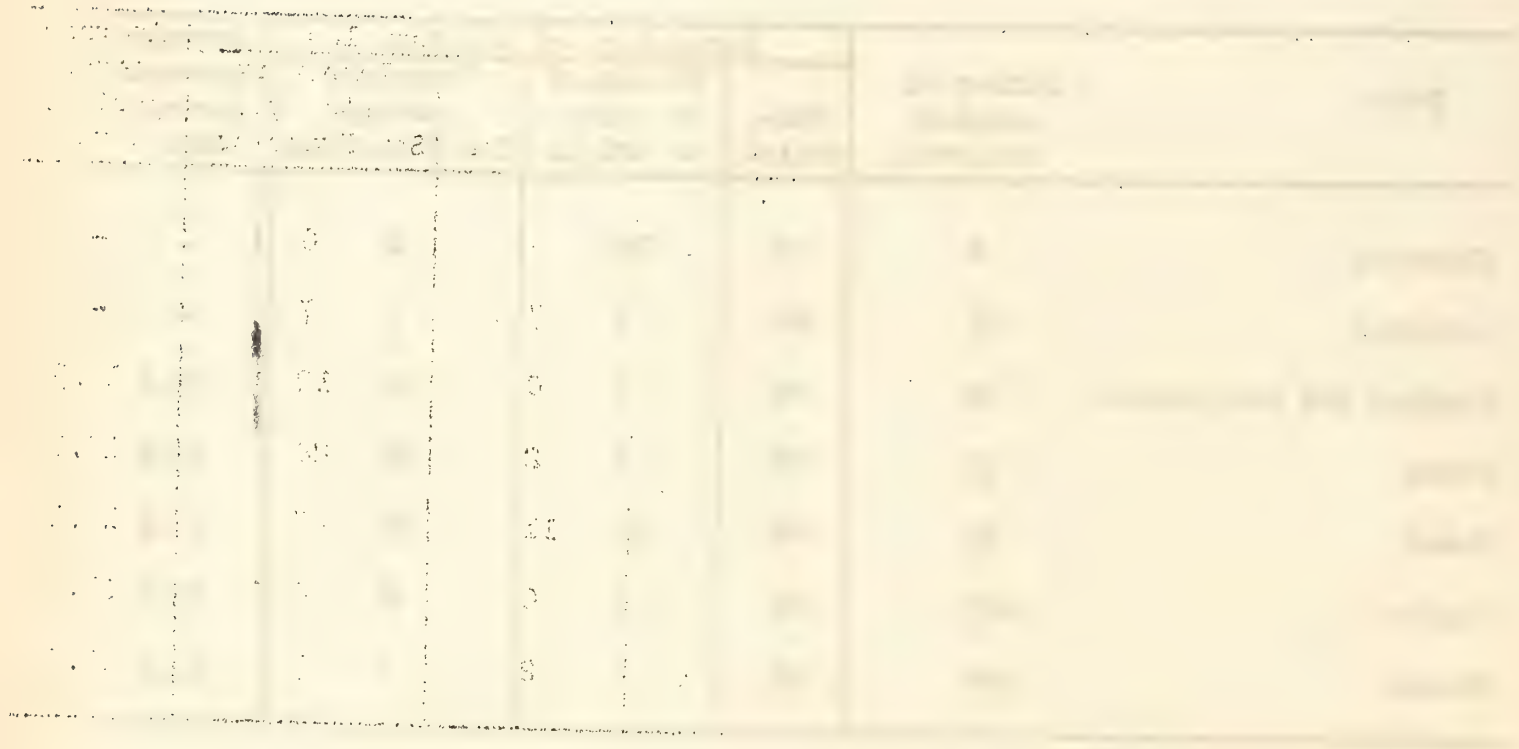
Length of Time in Transit to Shipside.- The time required for fruit to arrive in San Francisco from the various producing sections is usually from 2 to 12 hours. Shipments loaded in the late afternoon can therefore be delivered the following morning. Truck and boat shipments moving during the night avoid the heat of the day and at the same time secure a certain amount of 'precooling' from the night air.

Precooling before Loading.- The advantages of precooling perishable fruits destined for long shipments have been set forth by numerous investigators and the general value of quick cooling is widely recognized. The data in table 13, however, show that only a small percentage of the fruit for export shipment from San Francisco is precooled at point of origin. In fact, somewhat less attention seems to be paid to the handling of the softer fruits for export from San Francisco than is the case for transcontinental shipments, some of which are subsequently exported from eastern ports. The limited volume of soft fruits exported from San Francisco offers some explanation of this. In addition, many growers and shippers feel that the short haul to San Francisco does not justify the delay or the

TABLE 13

PERCENTAGE OF SAN FRANCISCO EXPORT SHIPMENTS PRECOOLED AT POINT OF ORIGIN AND PASSING THROUGH COLD STORAGE IN SAN FRANCISCO, JUNE 15 TO OCTOBER 15, 1930

Fruit	Number of samples observed	Percentage of samples			Average storage period, days
		Non-cooled	Precooled at point of origin	Temporary storage, San Francisco	
Cherries	4	75	25	0	-
Apricots	15	86	7	7	-
Peaches and nectarines	49	88	0	12	19.5
Plums	97	70	2	28	12.8
Pears	55	42	11	47	17.1
Apples	123	92	0	8	17.5
Grapes	124	91	2	7	11.3



expense of precooling. Moreover, some of the more important production centers of stone fruits are not equipped with cooling facilities. Excellent storage and precooling facilities are available in the Santa Clara Valley, the principal production center of winter pears and a large percentage of this fruit is either precooled or passes through storage before being shipped.

Most shippers agree that there is little or no necessity for precooling apples. Heavy shipments of table grapes do not move until relatively cool weather and if not placed in storage are usually not precooled before shipping. Late pears and apples pass through a storage/before being shipped. period

Owing to the lack of precooling facilities in many production centers, it has been advocated by some that export shipments be rushed to shipside and there precooled before loading into the holds of steamers. Regardless of the possible merits of this, the practice is limited because ships will not move from their regular berths for small tonnage. For this reason, fruit stored in the shipside terminal is at present, in most instances, transferred to various docks for loading just as is necessary with fruit held in storage plants off shore. During the survey, covering practically the entire season for the more perishable fruits, from 7 to 28 per cent of the export shipments of the stone fruits and 47 per cent of the pears passed through cold storage in San Francisco. The holding period varied from several days to several weeks. A few of these lots were under ice only long enough to remove the heat from the fruit (precooling proper) while other lots were held for as long as 30 days. The average number of days for storage for various fruits during the period June 15 to October 15 is shown in table 13. Apples and grapes are of course held for longer periods later in the season.

Temperature of Fruit as Received on Docks.- By means of fruit thermometers inserted in the packages, temperatures were taken as soon as possible after/export shipments were delivered on the docks. The average temperature of all nonprecooled lots corresponded very closely to the average air temperatures (60° to 70° F.) Peaches, plums, pears, and apples, however, very frequently registered a temperature 10° F. higher, and in the case of several shipments of grapes in kegs, 15° to 20° F. above that of the outside air. Maximum, minimum, and average temperatures are shown in table 14. For comparison, similar data are presented with fruit previously cold stored. The temperatures of this fruit, while generally 15° to 20° F. below that which has not been subjected to refrigeration, was materially higher than would ordinarily be anticipated. This is explained by the fact that much of it is first removed to local stores or assembling houses before being delivered to the docks. In some instances there may be a delay of several days.

Precooled pears arrived at an average temperature of 56° F., slightly higher than those passing through storage in San Francisco. Minimum temperatures recorded were the same in both instances, while 58° F. was the maximum noted on any precooled lot.

The average air temperature on the docks in San Francisco during the summer and fall months usually fluctuates around 65° F. A maximum temperature of 76° F. and a minimum of 56° F. were recorded, each in a single instance. The occasions when the temperature dropped below 60° F. or rose above 70° F.

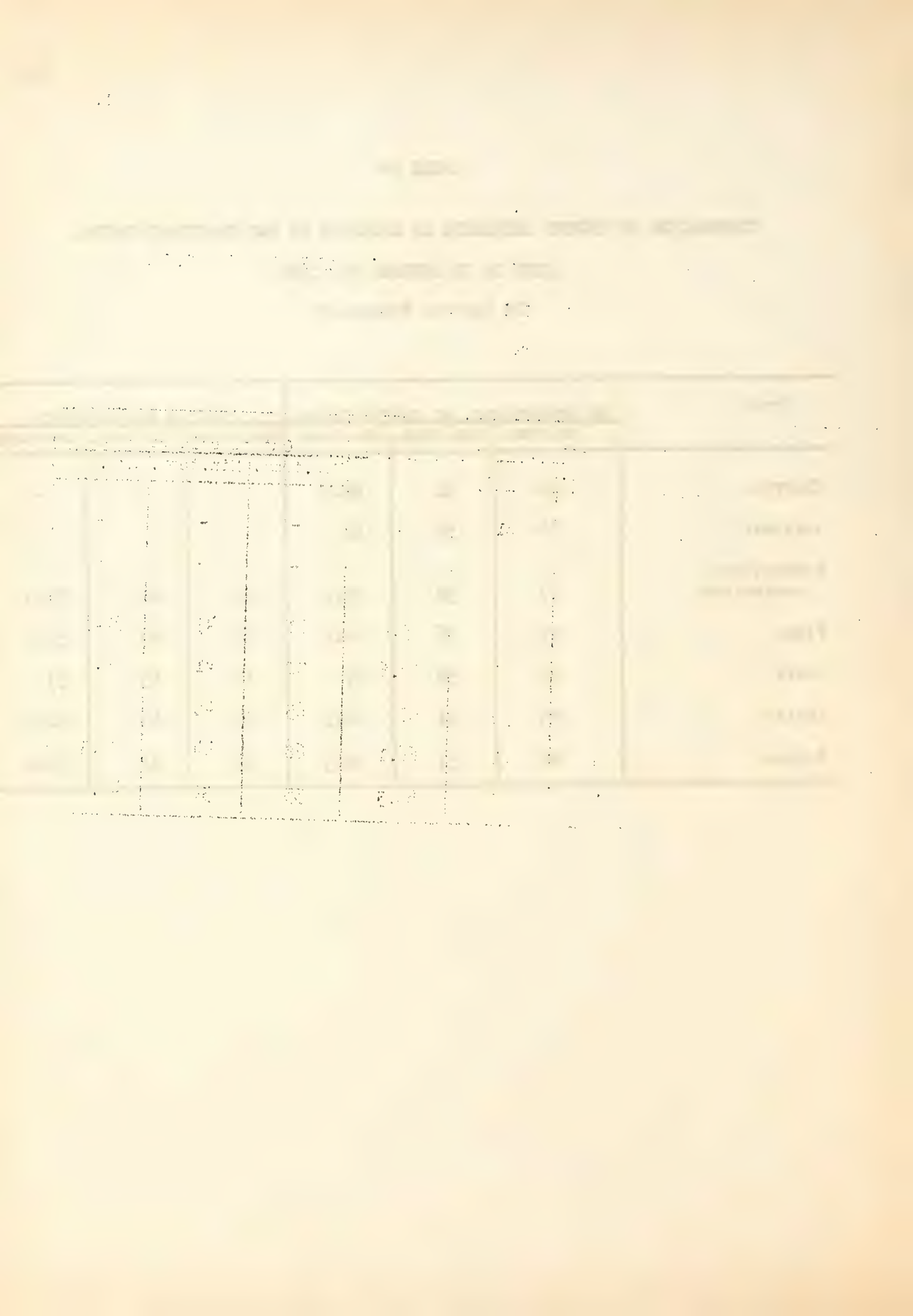
TABLE 14

TEMPERATURE OF EXPORT SHIPMENTS AS RECEIVED ON SAN FRANCISCO DOCKS,

JUNE 15 TO OCTOBER 15, 1930

In degrees fahrenheit

Fruit	No precooling, no refrigeration			Out of cold storage		
	Max. temp.	Min. temp.	Ave. temp	Max. temp.	Min. temp.	Ave. temp
Cherries	64	61	62.5	-	-	-
Apricots	64	59	62	-	-	-
Peaches and nectarines	77	58	65.4	68	49	56.5
Plums	78	56	64.6	58	41	50.8
Pears	76	59	67	65	45	53
Apples	75	61	66.1	68	44	50.3
Grapes	86	57	68.3	55	38	49.8



were comparatively few. This relatively cool and uniform temperature furnishes much more favorable loading conditions for fruit than are found at interior shipping points. Shippers give this as a reason for not precooling more fruit at the point of origin.

Condition of fruit on Arrival.- The quality and condition of the fruit on arrival at San Francisco showed considerable variation. Some few shipments of the larger fruit companies, exporters, or large individual growers contained selected fruit especially packed for export trade. Most shipments, however, do not appear to be different from those destined for domestic markets.

Earlier shipments frequently contained immature fruit, while in various instances, in the case of peaches and plums, soft and fully ripe specimens were found in the same box or crate with those in nearly ideal condition. A few such fruits in a package are capable to causing considerable damage to the adjacent specimens.

Loading of Fruit.- In certain instances refrigerated car shipments are spotted along shipside and loaded directly into the ship's holds. In most cases, however, fruit arriving for immediate export is first unloaded on the dock. In view of the fact that most export shipments of perishable fruits from San Francisco at the present time are in less than carload lots, this practice is necessary because the packages must be marked and in most cases divided into different lots for different ports. This is particularly true with the earlier fruits, such as cherries, apricots, peaches, nectarines and plums, and with vegetables, all of which move in small quantities. In loading into holds, the cargo for the last port of call is loaded first, while that for the first port is loaded last. All shipments destined for any single port are therefore assembled and loaded together.

Delay in Loading.- Most steamship companies make an effort to load perishable products as soon as possible but the practice of loading all goods for one port together necessarily results in some delay, which at times is of 2 to 3 days' duration. The usual delay in loading is between 1 and 6 hours with an average of about 2 hours. Shipments which are not loaded within 6 hours after arrival remain on the dock until the following day, and in a few instances until the second day. Twnety-four hour delays are more frequent with pears, apples, and grapes than with the softer fruits. Fruit from iced cars or from storage is apparently subject to the same delay as that which has not been cooled (see table 15).

Results of Delay.- With shipments which have been removed from a well-iced car or from a cold-storage warehouse, the most obvious result of delays in loading is the 'sweating' or deposition of moisture on the fruit. Even with the relatively cool temperature on the San Francisco docks, fruit which is 20° to 30° F. below the temperature of the air will quickly show this condition. While little definite information is available as to the harmful effects of sweating, it is generally regarded as objectionable and conducive to the development of various forms of molds.

Fruit which has been thoroughly precooled in iced cars or removed from cold storage is subject to the loss of temperature and to sweating.

TABLE 15

PERIOD OF DELAY IN LOADING DECIDUOUS FRUITS FROM SAN FRANCISCO INTO HOLDS OF SHIPS

JUNE 15 TO OCTOBER 15, 1930

Fruit	Number of lots	Percentage delayed less than 6 hours	Average hours delay	Percentage delayed more than 6 hours	Average hours delay
Pre-cooled fruit					
Cherries	2	100.0	0.5	-	-
Apricots	11	91.0	1.6	9.0	19.0
Peaches and nectarines	43	86.5	2.1	13.5	21.3
Plums	77	89.8	2.5	11.0	28.3
Pears	26	73.0	1.9	27.0	20.3
Apples	129	59.0	2.4	41.0	24.5
Grapes	124	74.0	2.1	26.0	23.7
Fruit from iced cars					
Cherries	7	86.0	0.8	11.0	18.0
Apricots	1	-	-	100.0	26.0
Peaches and nectarines	6	83.3	1.8	16.6	20.0
Plums	3	66.0	3.0	33.0	26.0
Pears	13	54.0	2.4	46.0	21.6
Apples	4	50.0	0.5	50.0	20.0
Grapes	14	80.0	2.5	20.0	27.3
Fruit from cold storage					
Cherries	-	-	-	-	-
Apricots	-	-	-	-	-
Peaches and nectarines	6	100.0	2.3	-	-
Plums	14	78.5	1.8	11.5	21.0
Pears	30	73.0	1.7	27.0	20.6
Apples	12	87.0	2.8	13.0	22.0
Grapes	9	100.0	1.6	-	-

The greater the difference between the fruit temperature and that of the air, the more rapid the loss. General averages given in table 16 show that fruit removed from iced cars has, when delivered on the docks, a temperature of 53° F. or approximately 12° lower than air temperatures or fruit which has not been cooled. With this relatively small difference in temperature the loss of refrigeration under normal delay is not great.

A second result of delay in loading is that the general ripening of the fruit may be unduly hastened. As previously pointed out, air temperatures on the San Francisco docks are relatively low and comparatively uniform from day to day. There is, therefore, almost no change in the actual temperature of noncooled fruit between the time of its arrival and the time of loading. Fruit coming from the interior valleys may become slight cooler rather than warmer while waiting to be loaded. It may be pointed out, however, that in all cases it would cool quicker and most likely show somewhat better carrying qualities it it were immediately stored under a 32° F. temperature rather than left exposed to 65° F. Most deciduous fruits stored at 60° to 65° F. will ripen approximately eight times as rapidly as that stored at 32° F.

Fruit which had passed through storage was received on the docks at practically the same temperature as that unloaded from iced cars, and consequently on the average the loss of refrigeration through delay in loading was no greater.[4] Inasmuch, however, as all deciduous fruit in cold

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4. The only reasons which can be offered for the high temperature of fruit out of storage are that it is not moved directly from the storage warehouse to the docks, and in some instances there was a delay of 1 to 2 hours in taking the temperature.

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storage is usually subjected to a temperature of about 32° F. and as very few of the lots recorded were under refrigeration less than a week, it is evident that this fruit was considerably cooler when first removed from cold storage than when it was delivered to the docks. Instead of a temperature gain of 2° F. as shown in table 16, a difference of 20° F. would seem more nearly correct. However, the lowest temperature recorded for cold-storage fruit when received on the docks was one shipment of grapes at 38° F.

Somewhat more striking examples of the increase in temperature of the fruit caused by delay in loading are shown in table 17. These are the more unusual cases, although they occurred rather frequently. Moreover, with heavy shipment of grapes, pears, and apples from storage such instances are expected to increase.

Existing Temperatures in the Holds of Vessels.- In discussions of shipside storage it is usually assumed that the fruit will be loaded into a hold of approximately the same temperature as that under which it was stored. It was found, however, that at the time of loading, most vessels make no attempt to maintain low temperatures in refrigerated compartments, and unless the hold is partially loaded at some previous port, refrigeration is in most instances entirely cut off. As a result, the average temperature in the

TABLE 16

AVERAGE ARRIVAL AND LOADING TEMPERATURES OF FRUIT, SAN FRANCISCO,

JUNE 15 TO OCTOBER 15, 1930

In degrees fahrenheit

Fruit	Fruit delivered from								
	Non-cooled cars and trucks			Iced cars			Cold storage		
	Average temperature			Average temperature			Average temperature		
	On arrival	When loaded	Gain	On arrival	When loaded	Gain	On arrival	When loaded	Gain
Cherries	62.5	63.5	1.0	59.0	61	2.0	-	-	-
Apricots	62.0	62.6	0.6	-	-	-	-	-	-
Peaches and nectarines	65.4	65.4	0.0	59.3	60.2	0.9	56.5	57.3	0.8
Plums	64.6	64.8	0.2	53.3	57.3	4.0	50.8	54.3	3.5
Pears	67.0	67.0	0.0	50.1	54.0	3.0	53.9	55.2	1.3
Apples	66.1	66.6	0.5	44.0	47.0	3.9	50.3	52.8	2.5
Grapes	68.3	68.3	0.0	56.1	57.5	1.6	49.8	51.0	1.2
Average of all fruits	65.1		0.3	53.6		2.5	52.2		1.8

TABLE 17

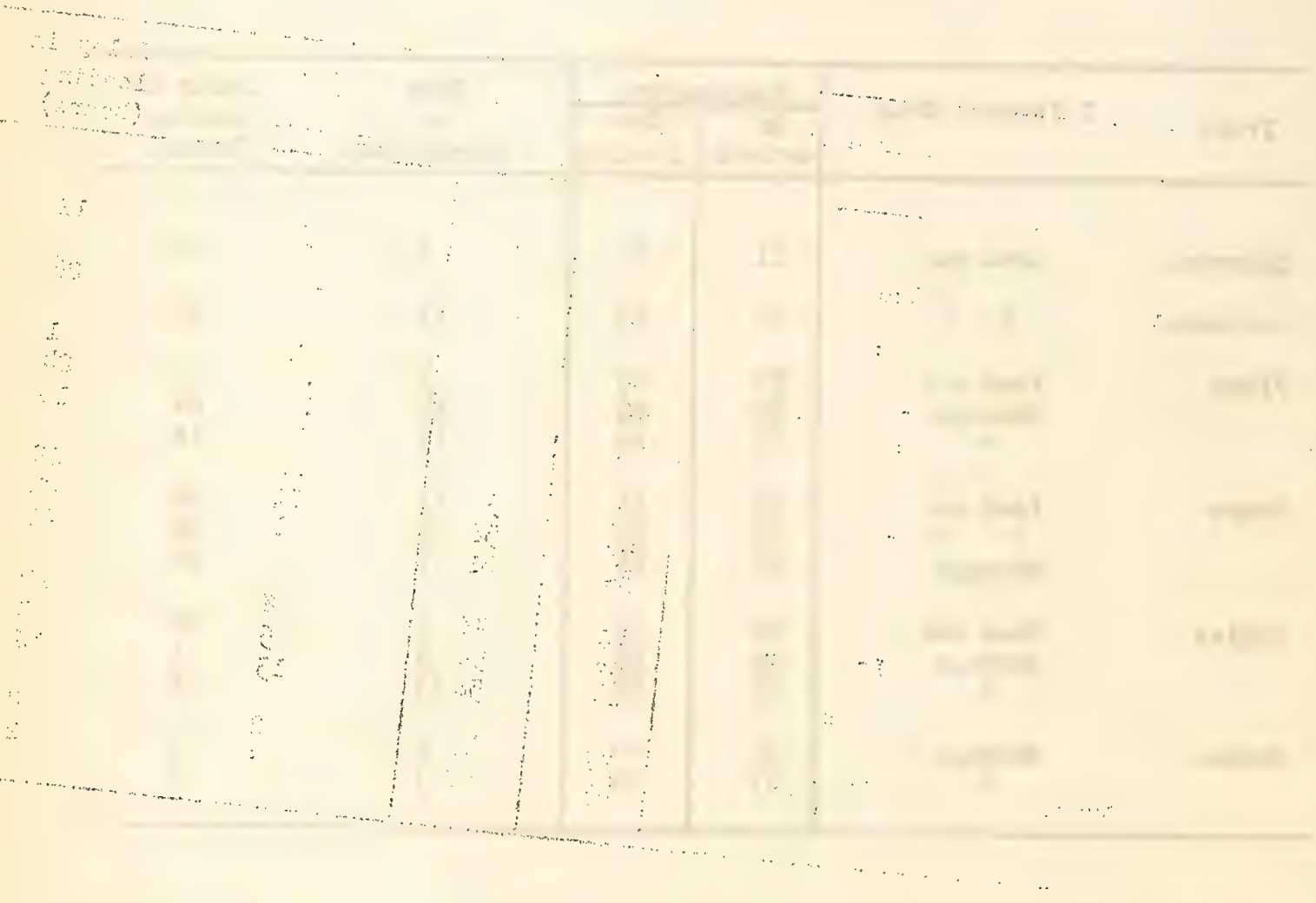
EXTREME CASES OF INCREASE IN TEMPERATURE

OF FRUIT SUBJECT TO DELAY AT SAN FRANCISCO

JUNE 15 TO OCTOBER 15, 1930

In degrees fahrenheit

Fruit	Delivered from	Temperature		Gain in temperature	Delay in loading (hours)
		On arrival	When loading		
Cherries	Iced car	61	70	9	18
Apricots	" "	40	53	13	26
Plums	Iced car	59	63	4	1
	Storage	45	59	14	24
	"	45	62	17	18
Pears	Iced car	45	56	11	22
	" "	46	58	12	22
	Storage	54	61	7	20
Apples	Iced car	40	48	8	20
	Storage	53	58	5	3
	"	45	58	13	18
Grapes	Storage	38	40	2	2
	"	47	50	3	2



holds of 62 vessels at the time of loading was 58° F. The minimum loading temperature recorded was 37° F. while the maximum was 71° F.; the higher temperatures predominated. With an average temperature of 58° F., refrigerator compartments of most boats were only slightly cooler than the noncooled fruit to be loaded into them. On the other hand, as shown in table 18, precooled or storage fruit is frequently loaded into holds at or above the prevailing air temperature.

Several of the larger boat lines show rather consistent average differences of as much as 10° F. in the temperature of their holds at the time fruit is being loaded. Individual boats, however, vary in their loading temperature at different dates. A hold registering 45° F. at one time may be without any refrigeration on some subsequent date.

Lower loading temperatures were not maintained primarily because:

1. It is not considered necessary and would be an additional expense.

2. Steamers having the open type of holds find low temperatures difficult or impossible to maintain while loading.

3. With ships having the brine pipe system of refrigeration any attempt to maintain very low temperatures in the rooms while loading results in dripping of moisture from the pipes. However, where pipes are located both overhead and on the sides of the compartment, some refrigeration may be turned into the side pipes. This is usually done when a portion of the cargo has been loaded at some previous port of call.

The extent to which temperatures are maintained at 36° to 38° F. while boats are enroute, and the time required for the holds to be lowered to such temperatures, have not been ascertained in this study. Overholser,[5]

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5. A study of the shipment of fresh fruits and vegetables to the Far East. Overholser, E. L. California Agr. Exp. Sta. Bul. 497: 7-11.

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however, reports that the air temperatures of the Silverhazel throughout its trip of 50 days to the Orient were maintained at 36.8° to 38.3° F. The loading temperature of the above vessel in San Francisco on September 13, 1930, was 45.7°. Average fruit temperatures at this time were 64.5° F. Five days after leaving port air temperatures in the holds registered 35° F., while not until after 16 days did fruit temperatures reach this point. Smith, of England, who has made extensive studies of fruit transportation from Australia reports[6] that under favorable circumstances of loading apples at 48° F.

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6. Smith, A. J. M. Temperature conditions in refrigerated holds carrying apples. Low Temperature Research Station, Cambridge, England. Dept. of Scientific and Industrial Research Food Investigation. Spec. Rept. 27: 10-11, 1926.

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to 50° F. in precooled holds at 40° F., it took 14 to 18 days to reduce the fruit temperature to that of the surrounding air. The rate of cooling of the fruit naturally depends, not only upon its initial temperature, but upon the

TABLE 18

FRUIT AND VESSEL TEMPERATURES, SAN FRANCISCO

JUNE 15 TO OCTOBER 15, 1930

In degrees fahrenheit

Date	Fruit	Temperature at which received	Temperature at which loaded	Temperature of ship hold
July 30	Apricots	40	53	62
August 1	Dizmar grapes	55	55	70
August 12	Gravenstein apples	46	46	69
August 13	Gravenstein apples	48	48	65
August 14	Gravenstein apples	41	55	65
August 14	Hardy pears	51	55	65
August 15	Malaga grapes	52	52	65
August 15	Malaga grapes	45	45	66
August 26	Malaga grapes	38	40	66
August 27	Bartlett pears	46	47	70
September 9	Bosc and Anjou pears	54	56	68
September 11	Hungarian plums	41	46	71
September 11	Anjou and Comice pears	45	56	68
September 12	Emperor grapes	56	58	71
September 12	Bartlett pears	54	61	71
September 12	Winter Banana apple	45	48	71
September 16	Plums	45	62	69
September 17	Delicious apple	44	51	64
October 15	Bartlett pears	39	47	61

type of package, the method of packing, of loading, and the kind and amount of refrigeration available. Unwrapped fruit such as apricots or plums in open crates will reach atmospheric temperature much sooner than closely packed and wrapped fruit such as pears or apples, or grapes in sawdust. Under warehouse conditions the former fruits can be thoroughly cooled in 12 to 24 hours while the latter requires 3 to 6 days. Cooling large quantities of warm fruit on board ship with a minimum air temperature of 36° F. will require considerably longer.

Summary of Handling Practices.- It is generally recognized that quick cooling of fruit appreciably retards its ripening and is one of the most important factors in handling the more perishable fruits for shipment to distant markets. This cooling prior to shipment, often spoken of as precooling, is now practiced rather extensively in some fruit-producing sections before shipments are loaded into refrigerator cars for transcontinental shipment.

If the value of precooling is thus recognized with overland shipments, will it not also be of value with export shipments from San Francisco? Fundamentally the results of precooling are the same in all cases. To be of most value, however, it is essential that after fruit is once cooled it is not subsequently exposed to high temperatures. Precooling for transcontinental shipment is done in the cars themselves or the precooled fruit is loaded directly into the refrigerated cars from a cold-storage warehouse. With water shipments, however, there is the problem of the local haul to shipside.

The data presented above show that only a small percentage of fruit shipments is unloaded directly from iced cars into the holds of ships. Fruit precooled to 50° F. or below is therefore subject to a loss of some refrigeration and to sweating while waiting to be loaded. Temperatures taken in the holds of ships also indicate that precooled fruit or fruit out of storage may likewise be subject to these same conditions after loading.

It appears, therefore, that there is no necessity to advocate the more extensive precooling of fruit for export from San Francisco until such time as the volume of export orders will justify ship lines in furnishing the deciduous fruit grower and shipper with temperatures comparable at the time of loading to those available in a cold-storage warehouse.

TRAFFIC SITUATION IN SAN FRANCISCO BAY HARBOR

The traffic situation in the San Francisco Bay harbor has an important bearing on the location of a shipside cold-storage terminal.

As was pointed out earlier, Oakland and San Francisco are equally feasible as far as freight rates are concerned. However, the traffic situation in the harbor itself favors San Francisco. Most ships handling refrigerator cargo call at San Francisco but do not call at Oakland. The general rule is that ships which dock at one slip or quay will not move for a cargo of less than 500 tons although when cargo is scarce some ships will move for 350 tons.

According to Mr. L. King, Traffic Manager of the State Board of Harbor Commissions, the usual size of fresh fruit cargo is around 8,000

boxes, or 160 tons. Consequently, it is doubtful if many ships would move to the Oakland side for this cargo alone.

Both the water-traffic situation and the rail traffic situation have an important bearing on the choice of the exact location of a shipside cold-storage terminal in the San Francisco Bay harbor. According to a survey made by the Pacific Rural Press, 68 per cent of the actual and contemplated service of refrigerator space of ships is now utilizing the facilities provided at the State Products Terminal. Possibly most of these ships would move to some other point on the harbor. Yet this situation is in favor of the present location.

The present location has an advantage over a site located south of the China Basin in that the present facilities are served by the Belt Line Railroad. Traffic destined for a site south of China Basin would have to pass through a congested district and bear additional charges for going through the Santa Fe yards. This disadvantage of a site south of the China Basin may be eliminated if the plans for the development of the San Francisco Bay harbor are approved and carried out. However, it is not certain, if an increased demand for shipside cold storage should develop, the facilities for this service ought to be concentrated at one point in the harbor. The development of the slip system of docking in San Francisco is the result of the impracticability of concentrating all cargo at a few points. In other words, it has been found advisable to develop transit sheds at shipside rather than storage sheds. In view of this situation it may be advisable to develop additional cold-storage space on a number of slips rather than at one point on the harbor if the demand for this service increases rapidly.

COSTS OF PRECOOLING

The costs of precooling at shipside are more or less indeterminate under present conditions unless detailed analyses are worked out. The State Products Terminal has operated for a period of less than one season (June 15 to October 15, 1930) under partial capacity.[7] Moreover, most of

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7. Subsequent to the completion of this study, during November and December, 1930, the plant was filled to capacity.

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the products handled at this terminal have not been placed in the precooling chambers. Costs of Portland and other Pacific Coast ports have not been secured but at these, also, fruit precooling is more or less incidental to a general terminal business. It is evident, however, that present costs of operation of the State Products Terminal are much higher than may be expected with increased use of the precooling chambers.

The rates for precooling at the State Products Terminal are set forth in the rules, regulations, and charges issued by the Board of State Harbor Commissioners effective May 14, 1930.

As an example, for pears in standard boxes, the precooling rate for 10 days or less is 75 per cent of the following first-month commodity rates:

Lots under 50 boxes	11	cents	a box
Lots 50 to 300 boxes	10	"	"
Lots 300 boxes or more	9	"	"

At a commercial plant (San Jose) pears are charged for at the rate of 10 cents a box for the first 5 days.

It is to be noted that the commercial rate is higher than the state warehouse rate. The former, however, is fixed by the State Railroad Commission.

Car precooling is practiced in certain areas. A flat charge of $50.00 a car is made for cooling from 4 to 8 hours. When portable fans and ice are used for car precooling from 4 to 10 kw-hours of electric energy and about 1,500 pounds of ice are required to cool a car. These operating costs vary from $2.50 to $4.00 a car.

To obtain the full value of precooling at point of origin necessitates transportation by refrigerator car or barge to point of export. This additional cost, if shipped by iced refrigerator cars, is approximately 1 cent a box over the regular carrying charges.

Possibilities of Cutting Precooling Costs.- Refrigeration methods are well developed, and the greatest handicap to economical operation is variability of plant load. Many times a plant must operate with extremely low load factors. This is particularly true in plants devoted exclusively to precooling and in warehouses having no storage-in-transit privileges. Low costs are difficult to obtain in plants where there are wide fluctuations in the volume of fruit under refrigeration. The possibilities of cutting costs of precooling are, therefore, dependent upon the volume of products under refrigeration which in turn depends on transportation facilities, and other factors affecting the movement of fruit.

FINANCING SHIPSIDE COLD STORAGE

San Francisco Harbor is operated by the State Board of Harbor Commissioners on a nonprofit basis. "Port charges are reduced to a minimum sufficient for the efficient operation and maintenance of the port. San Francisco charges are the lowest of any port in the United States and the harbor facilities have not cost the people of the city or state one dollar in taxes." [8] ... The port of

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8 Biennial Report of the Board of State Harbor Commission 1924-1926: 10.

Seattle is operated as a port district. Seattle Harbor, though for the most part self-supporting, receives some revenue direct from state appropriation and if necessary, may levy a tax on property within the port district. Portland Harbor is a municipal project. It is a self-supporting and nonprofit activity like the port of San Francisco.

In any port it is impossible for every activity to yield a profit. Those piers regularly used furnish most of the revenue, while those used for transit trade bring in comparatively little. Certain facilities must be provided though seldom used. Port charges at San Francisco are, therefore, set at figures which will just cover expenses and provide for the necessary

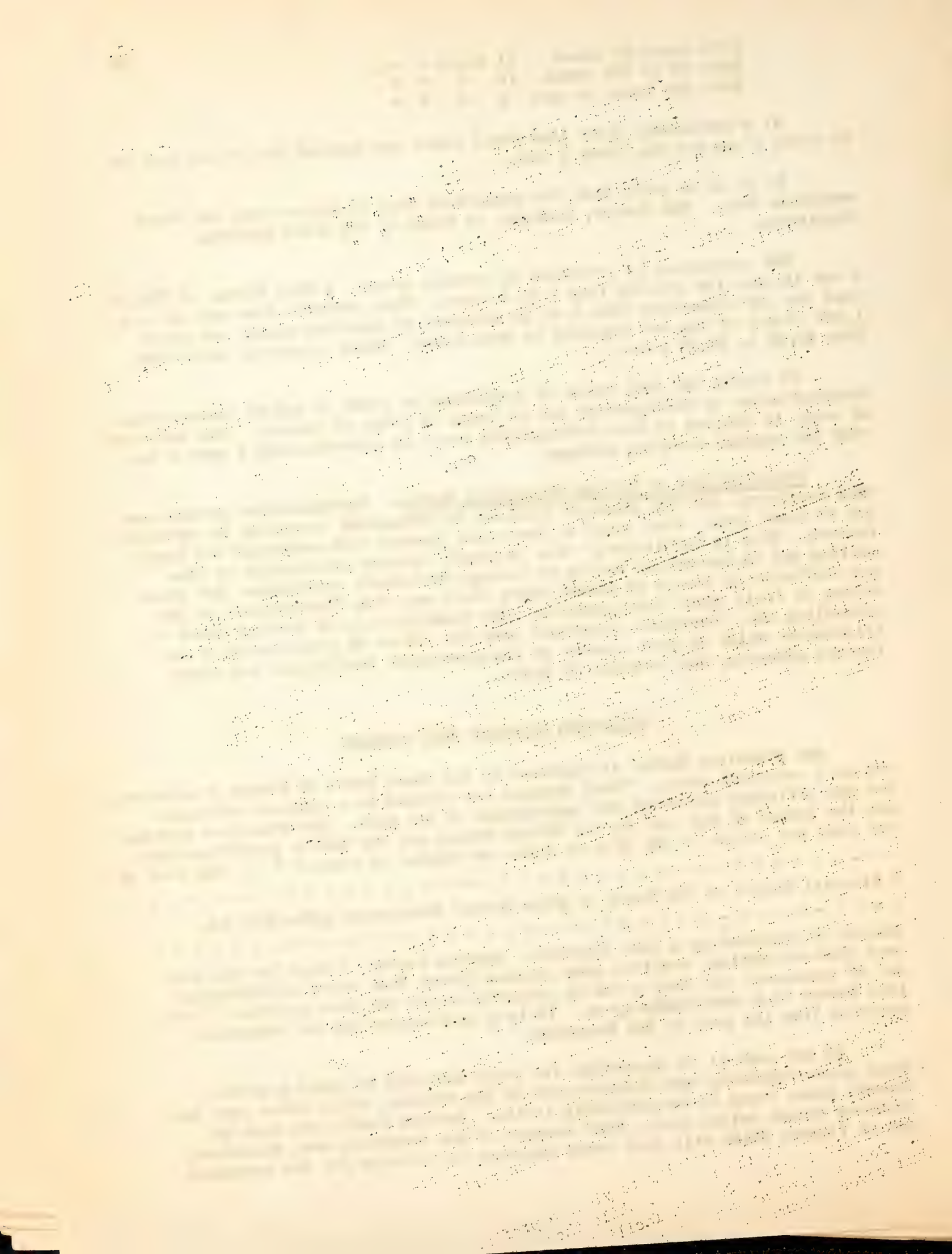


TABLE 19

PRINCIPAL COMMODITIES RECEIVED

COLD STORAGE WAREHOUSES, PORT OF SEATTLE

1925-1929*

Commodity	Unit	1929	1928	1927	1926	1925
Apples, fresh	Boxes	47,756	77,414	22,736	99,269	79,892
Butter	Cubes	8,115	11,543	5,704	8,675	7,229
Cabbage and cauliflower	Tons	65	177	135	177	459
Celery	Crates	1,663	4,410	4,074	7,624	10,023
Cheese	Tons	53	67	30	61	37
Eggs, fresh	Cases	5,940	25,424	55,984	63,575	27,297
Eggs, frozen	Tons	36	46	561	379	473
Eggs, dried	"	30	8	11	66	52
Fish, herring, barrel salt	Barrels	16,518	23,107	6,813	14,260	37,334
Fish, salmon, mild cure	Tierces	11,684	8,585	12,301	7,460	10,299
Fish, salt, barrel, N.O.S.	Tons	47	50	90	22	-
Fruit, fresh, pears	Boxes	8,156	8,104	2,044	5,120	9,960
Fruit, preserved, berries, etc.	Barrels	4,806	36,216	21,424	32,800	12,008
Meat, fresh, N. O. S.	Tons	75	457	325	189	60
Meat, fresh, reindeer	"	724	716	389	291	379
Meat, salt and smoked	"	129	215	108	-	3
Nuts, except peanuts	"	912	553	564	623	418
Onions, dry	Sacks	566	838	1,840	2,980	4,460
Peanuts	Bags	19,094	21,550	19,640	73,920	60,060
Potatoes	Sacks	4,344	14,944	13,520	34,500	26,520
Poultry	Tons	86	128	70	31	21
Vegetables, fresh, not otherwise specified	"	203	152	173	118	719

* Data from Port of Seattle Yearbook, p. 52, 1930.

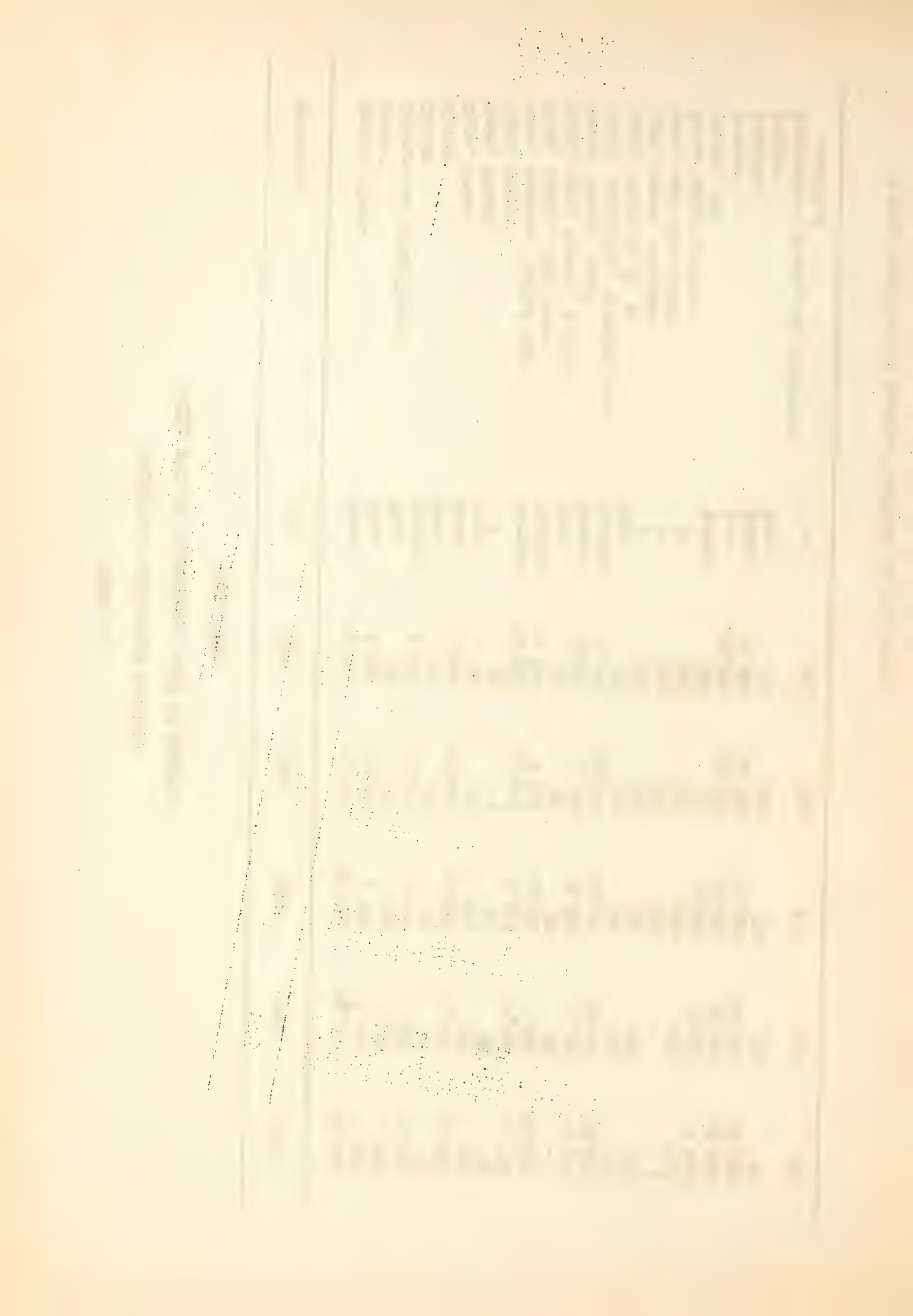


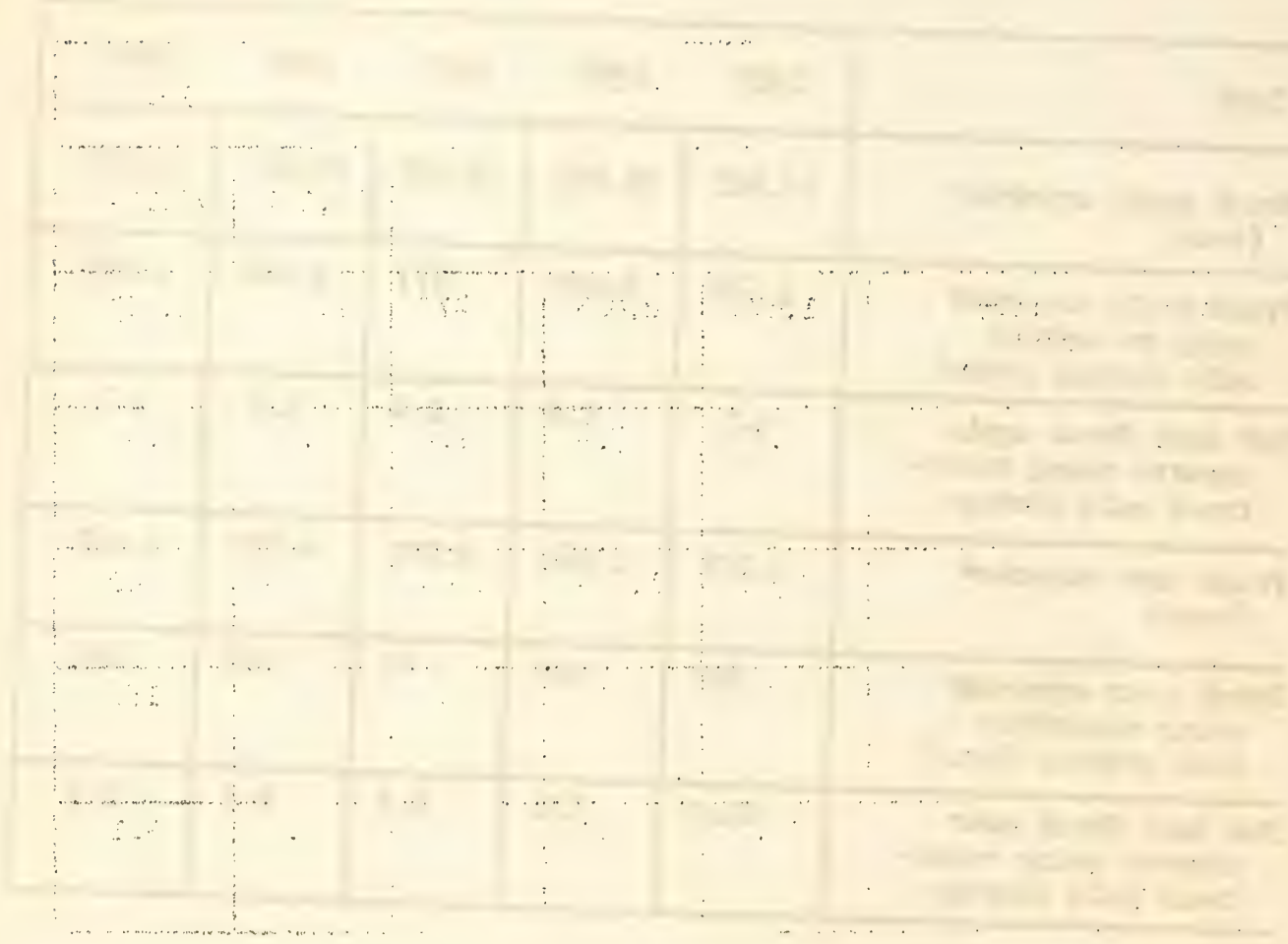
TABLE 20

FRESH APPLE AND PEAR EXPORTS FROM THE SEATTLE CUSTOMS DISTRICT AND THE PROPORTION OF THESE EXPORTS USING WATERFRONT COLD STORAGE, 1925-1929

Year	1925	1926	1927	1928	1929
Fresh apple exports* (tons)	18,421	28,093	33,632	49,147	79,113
Fresh apple exports# using waterfront cold storage (tons)	1,678	2,085	477	1,626	1,003
Per cent fresh apple exports using water-front cold storage	9.1	7.4	1.4	3.3	1.3
Fresh pear exports* (tons)	2,301	1,664	2,003	4,373	6,062
Fresh pear exports# using waterfront cold storage (tons)	299	118	47	186	188
Per cent fresh pear exports using water-front cold storage	10.0	7.1	2.3	4.3	3.1

* Data from table 2.

\# Data computed from Port of Seattle Yearbook p. 52, 1930.



development of port facilities.

Publicly owned shipside cold storage is a recent development and still in the experimental stage. The Belle Street cold-storage plant of the Seattle Harbor has 7,500 tons or 690,327 cubic feet storage capacity, while the cold-storage plant at Terminal No. 4 of the Portland Harbor, built in 1923, has a 3,500 ton or 245,000 cubic feet of storage capacity. The plant at San Francisco, which was put into operation this summer, has a 3,000 ton or 210,000 cubic feet storage capacity. The San Francisco plant is the only one from which direct loading of cargo into the ship's hold is possible. At Seattle there are double tracks and a 70-foot loading shed between the ship and cold-storage plant. Portland's cold-storage plant is approximately 500 feet from the pier head.

The object of building these cold-storage plants has been to encourage export shipments of perishable commodities. In Seattle the fishing industry has used these facilities more than agriculture (table 19). The use of the shipside cold-storage plant for fresh fruit exports has not increased in relation to the volume of exports. Data in table 20 show that 9.1 per cent of all the apples exported from the port of Seattle in 1925 were precooled at the publically owned cold-storage plant but in 1930 only 1.3 per cent were precooled there. In the case of pears, 10 per cent of these exported in 1925 were precooled at the harbor cold-storage plant while in 1930 only 3.4 per cent were precooled there. These figures indicate that in Seattle the use of precooling facilities for apples and pears, which constitute the bulk of fresh fruit exports, has not increased rapidly.

The San Francisco plant has not been in operation long enough to determine the volume of business or the trend of the development that can be expected. Present indications lead to the belief that it will be a long time before this project is self-supporting.

In San Francisco privately owned cold-storage interests doubted the profitableness of shipside cold storage. The State was induced to undertake this development. The impression that shipside cold storage is an enterprise suited only to public ownership is contradicted by the fact that the Pennsylvania Railroad is preparing to build in New York Harbor a shipside cold-storage plant having a capacity of 27,000,000 cubic feet of storage, the first unit of which will be completed by the end ot this year with a capacity of 6,000,000 cubic feet, 4,000,000 of which will be devoted to cold storage.

RELATION OF QUICK FREEZE PROCESS TO SHIPSIDE REFRIGERATION

Several factors which may ultimately have a bearing on the problem of shipside refrigeration are at the present time unmeasurable. Chief among these is, perhaps, the recent development of the sale of foods in a frozen state. In this connection, the freezing of certain fruits and fruit juices is of particular importance to California producers.

M. A. Joslyn [9] states: "The fact that large quantities of fruit can be

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9. Joslyn, M. A. Preservation of fruits and vegetables by freezing storage. California Agr. Exp. Sta. Cir. 320: 35. 1930.

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packed rapidly, simply, and with relatively small investment for machinery and containers permits the use of freezing storage in years of large crops as a means of preserving some of the surplus. However, while the methods and equipment are relatively simple, extensive cold-storage space is required. The cost of storage naturally increases with the length of storage. Not only the storage but also the distribution of the product requires refrigeration. The product must not only be kept frozen during transit and distribution to the retailer, but must be kept frozen by the retailer. Moreover, housewives have to be instructed in the proper use of the frozen product. Thus the development of the industry may be limited not only by the cost of refrigeration facilities but also by their availability."

How rapidly the practice of distributing frozen foods will develop is difficult to predict. Several large distributing companies are now experimenting with the retailing of frozen foods. Frozen meats are reported to be rapidly gaining consumer acceptance. Certain frozen fruits have for a considerable time been sold to pie factories. The freezing of vegetables is not as far advanced. M.A. Joslyn reports: "Until methods for freezing and distributing vegetables are properly standardized and distribution properly safe-guarded it is advised that the freezing storage of nonacid vegetables be undertaken with the greatest caution and only under advice of the State Board of Health."

As was stated above, it is difficult to anticipate the development of the distribution of frozen foods. Should the development be rapid it may have an important bearing on shipside refrigeration in the San Francisco Harbor.